A TEXT-BOOK

OF

FIRST AID AND EMERGENCY TREATMENT

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PREFACE.

In the preparation of this book the author has kept in mind the requirements of both the untrained first-aid worker and the advanced student who may be expected to practise the art under the conditions of modern warfare.

In its essentials the practice of first aid is the same whether the worker is surrounded by the conveniences of a civilized community or is in the wilderness or upon the battlefield. In any of these places emergencies may occur which in the absence of skilled medical aid require immediate volunteer treatment, the character of the services being determined by the skill of the volunteer and the available medical and surgical supplies.

This book is intended to so train the volunteer assistant that when the emergency occurs he may be able to apply the principles of first aid to the case at hand.

In addition the volume has been made complete in many small details, so that the advanced worker may find it a reliable reference book for both field and hospital work, and the camper and yachtsman, in the absence of a physician, may find in it sufficient information to enable him to assume temporary care of the sick and injured.

In teaching first aid in the conventional course of six or eight lessons, it has not been the author's custom to attempt to cover the entire book. Such a plan being impracticable, he has endeavored to fix the principles of treatment thoroughly in the minds of the students, so that the interest thus aroused will lead them to a further study of the lesser details.

In conducting his courses the author has found it advantageous to combine a part of the anatomy and physiology with each lecture on treatment. Thus the anatomy of the bones and the joints is given in the lecture on fractures and dislocations, and the anatomy and physiology of the circulation is given in connection with hemorrhage.

Complete instruction on bandaging and transportation can be given only to those who are able to devote considerable time to this subject. This is intended more especially for the Sanitary Corps of the Army and Navy, organizations of Boy Scouts, nurses' aids, and others who expect to qualify for similar duties.

The character of the text deviates considerably from that of many of the older books, the student being drilled in the principles of diagnosis and treatment instead of being limited to didactic rules of procedure in individual cases. The modern methods of treatment have been given special prominence, though the older methods of proven worth have not been omitted. New and untried remedies, the value of which is still largely problematical, have not been discussed.

This book is based upon an experience of many years in the emergency wards of some of the largest New York Hospitals and on wide experience as a teacher of first aid. It has two aims: the first, and less important, is the education of the student in first aid; and the second, of considerably greater importance, is the alleviation of suffering and the saving of life.

A. C. B.

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FIRST AID AND EMERGENCY TREATMENT.

CHAPTER I.

GENERAL PRINCIPLES OF FIRST AID.

The present conception of first aid defines the term as that expert assistance which may be given by a layman in the emergency treatment and transportation of the sick or injured. It should include the relief of pain, the prevention of further harm whenever possible, and the recognition of the seriousness of the condition present.

In its broadest sense, first aid may be given by the patient himself; by a layman with or without special training; by a professional nurse; or by a physician. Ordinarily, the usage of the term is limited to "that assistance which may be given by anyone who has had a certain amount of special training in the principles of first aid." It is in the latter sense that the subject will be treated in these pages.

The relief of pain is of the utmost importance. Pain not only causes the patient discomfort, but is an actual source of danger to life. It has been shown in animals that if, in addition to the primary injury, an animal is allowed to suffer severe pain for a long period, the general symptoms of shock and prostration become progressively more severe, often ending in death. If the pain due to the original injury is made less by the administration of opiates or by the protection of the injured part the tendency is toward recovery.

The prevention of further harm is equally important. In a patient who has had a moderate hemorrhage it is at once apparent that recovery will be made easier if further hemorrhage is prevented; in the case of a wound it is self-evident that care should be taken that the wound does not become infected; while a simple fracture is made much worse if a jagged end of the bone is allowed to penetrate the skin.

The ability to recognize the severity of the injury or the seriousness of the attack of illness is greatly to be desired in those who may be required to practise first aid, not only because it gives some indication of the treatment necessary, but also because it enables the first-aid worker to come to a conclusion as to how important it is to secure professional aid at once and to determine the necessity for the application of relief measures on the spot, or the advisability of transportation to a more suitable location.

For example, we might suppose that a man had been run over and was lying in the middle of the street. If the injury is slight, a scalp wound or a fractured wrist, he could be allowed to walk to a more convenient place to wait for a surgeon; or he might even walk to the nearest physician's office or hospital. If the injury is more severe, a fractured thigh, for example, and is associated with considerable shock, it is important that he be transported within a reasonably short time to a location where he may be kept warm and comfortable; but to attempt to carry him a long distance is not justified. If the injury is still more severe, such as a fracture or dislocation of the spine, an attempt at removal before all the necessary appliances and expert help is at hand would be very dangerous. Such a patient should be left where he has fallen until expert help has been secured. In this last case the occasion might arise where it would be wiser to remove the patient, even at a considerable risk, because the conditions might be such (for example, exposure to cold and rain for a long period while waiting for a surgeon) that the danger of removal would be less harmful than inactivity. In such cases the trained student in first aid will be able to give expert assistance while the untrained volunteer may only accomplish harm.

From the foregoing it is apparent that the student of first aid requires a certain amount of knowledge and a considerable degree of judgment. Following, as a natural sequence to these requirements, is the first rule of procedure in the application of first aid: Never act blindly without a good and sufficient reason for any method of treatment which you may adopt. When you have practised first aid for some time you will realize that emergencies which will not permit a short period for examination and consideration are extremely rare, and that hurried conclusions, made during a period of excitement, are more apt than not to be incorrect. A man fell from a scaffold and was seen at once by a first-aid enthusiast, who recognized the symptoms of shock. In order to treat the shock in a satisfactory manner he hurriedly carried the man into a neighboring house and put him to bed, entirely overlooking the fact that his patient had a badly fractured leg, which, during the trip to the house, became compounded,[1] with resulting infection of the wound. This error of judgment added considerably to the suffering of the patient and lengthened his period of disability.

The nature, extent and severity of the injury should be determined so that an intelligent message may be sent to the physician. If a physician is told that a man has been injured and apparently has a fracture or dislocation of the hip; or that a child has been run over and has large wounds of the head and arms, he will have some idea of what to bring with him, and the result will be that considerable time will be saved in the end. In addition, be sure that, in sending for a physician, directions are given so that he may come directly to the given location without difficulty. If there is any chance for a mistake, send someone to meet the physician, if possible. I have been called to an emergency case "on Broadway" by an excited individual who neglected to tell me on what part of Broadway, and to "Brown's Drug Store," by someone who hung up the receiver before I could tell him that I had never heard of such a store. In the country it is not uncommon to be instructed to turn down "Jones's Lane," when the physician is unacquainted with the locality and is unable to distinguish "Jones's Lane,"

[1] That is, the sharp end of the broken bone was forced out through the skin, adding a wound to the other injury.

from the many other lanes which branch from the main road. In such a case it is wise to send someone to meet the physician at the entrance of the lane, or at some other point easily located.

Find out all you can from the patient and the witnesses regarding the accident. While you are doing this note the condition of the pulse, the color of the face and lips, and the state of consciousness. Then, bearing the history in mind, make a careful examination to locate wounds, fractures, etc. The examination should be thorough and should be guided by the history and symptoms. However, a partial examination will often indicate the extent of the injury. Thus when a patient has stepped off the curb and turned his ankle, and is found sitting comfortably in a chair, it is hardly necessary to examine the arms for fractures, or the head for scalp wounds. It is to be supposed that in such a case the patient has enough intelligence to indicate the location of the injury. In other cases, where a man has fallen from a height and is only semiconscious, almost any conceivable injury may have occured, and the head, arms, legs, and back should be carefully examined.

If the injury is apparently severe it is well to send at once for blankets, hot-water bottles, stimulants, etc. If these are later found to be unnecessary it has done no harm to have them ready. Often the injury has been very slight, the patient having merely fainted from fear, recovery occurring in a few minutes without any treatment other than rest in the recumbent position. If the patient is in an uncomfortable position it may be necessary to move him at once to a place where he can be more conveniently examined. To do this, make a hurried examination to detect any injury which might be made worse by transportation, and then move him the shortest possible distance to a spot where a more thorough examination may be made.

If there is a wound, rip or cut the clothing away so that the injury may be plainly seen. Do not attempt to apply a tourniquet to stop hemorrhage before you have seen the bleeding-point. A case has recently occurred where a man bled to death from a ruptured varicose vein because no one had the intelligence to cut open the clothing and apply pressure with one finger against the bleeding-point. The man had been given a stimulant and had had a bandage wrapped about the bleeding leg, but no one had sufficient training in first aid to look for the bleeding-point and stop the hemorrhage by direct pressure.

If you do not know what to do, do nothing at all. It is never necessary to act for the mere sake of doing something. In the case mentioned above, if one of the bystanders had not secured a sheet and wrapped it about the leg, thus hiding the extent of the hemorrhage it is possible that someone else might have examined the leg and noticed that the blood came from one small point, and could easily be stopped by pressure.

FIG. 1.—Varicose veins of leg. A small wound of these veins bleeds profusely. (Park.)

Above all, remember that first aid is only common-sense combined with a little scientific knowledge. When you first see a patient, keep cool and do the obvious thing, such as putting out the fire in burning clothing, pulling a person out from under the horses' hoofs, getting him away from falling timbers, rescuing a drowning person, and other similar actions. Then proceed with the examination and do the thing which your knowledge of first aid teaches you is right and proper. But be sure to keep cool, and know what you are doing, and why.

The *United States Manual* gives the following general first-aid rules for the sanitary troops:

1. Act quickly and quietly.
2. Make the patient sit or lie down.
3. See the injury clearly before you treat it.
4. Do not remove more clothing than is necessary to examine the injury, and keep the patient warm with covering if needed. Always rip, or if you cannot rip, cut the clothing from the injured part, and pull nothing off.
5. Give alcoholic stimulants slowly and cautiously, and only when necessary. Hot drinks, when obtainable, will often suffice.
6. Keep from the patient all persons not actually needed to help him.

EQUIPMENT AND SUPPLIES.

The equipment and supplies needed by the first-aid worker vary within wide limits. The further the student progresses in first-aid experience, the better he is able, in an emergency, to secure satisfactory results with whatever supplies he may find at hand. In some cases he may be limited to those supplies which may be secured at an instant's notice; in others, he may have available all the surgical supplies of a well-equipped hospital. In general, it is better to use the specially prepared supplies when they are to be obtained, but the intelligent worker will often be able to improvise material and supplies with which he can attain most creditable results.

Thus, it is possible to obtain a sterile dressing by boiling a piece of linen or gauze or by dipping a clean handkerchief in alcohol. Personally, I have had excellent results, when sterile supplies were not available, by applying a clean handkerchief wet with cologne (or whisky) directly against a bleeding surface, and bandaging it firmly against the wound.

On one occasion a hospital orderly, while in bathing, accidentally cut a large vein in his leg, which bled profusely. He was near the shore, but a considerable distance from his party. There was literally nothing but sea and sand at hand. The man had had enough experience to know that he was in danger from the profuse hemorrhage, so he sat upon the beach and placed both thumbs in the wound, effectually stopping the hemorrhage. Twenty minutes later his friends found him and applied a permanent dressing. It may be added that although he did not receive medical treatment for several hours, the wound did not become infected. This was because the wound and hands had been well cleansed with sea water, which contains few pus-forming bacteria.

Although it is sometimes necessary to work with improvised tools, better results will be obtained if the proper supplies are at hand. Numerous first-aid kits have been advised, but they must, necessarily, vary considerably, the contents depending largely upon the purpose to which the packet is to be put. In the choice of a first-aid kit the following points must be taken into consideration:

1. The size and weight.
2. Character of injuries likely to occur.
3. The experience of the operator.

The size and weight are of the utmost importance. It is at once apparent that a complete equipment, such as might be ideal for a theater or factory, would prove much too large and heavy to carry on a canoe trip, while the kit carried in the canoe would be too large and heavy to carry on a tramp through the woods. If size or weight does not need to be considered, much more latitude may be given in the choice of supplies.

The character of the prevalent injuries in a given locality must also be taken into consideration. In certain factories burns are very common, so that extra preparation should be made for this injury. In others, small particles are apt to get into the eyes and provision must be made for their removal. On fishing trips the fish-hooks are apt to be stuck in the hands. I have known fishermen who carried a sharp pair of wire cutters when they were on long trips. If the hook is stuck too deeply into the hand to be withdrawn the point is pushed inward until the curve causes it to emerge from the skin. The barbed point is then cut away and the hook is easily withdrawn.

The skill of the operator should also be taken into consideration. If the first-aid worker has had no experience in the use of surgical instruments, it is unnecessary to include them in the outfit. In some cases, as on sea voyages and long trips into the woods, it is advisable to carry suture materials and simple surgical instruments, so that they may be used when required.

Probably the simplest form of first-aid packet is that used by the soldier. This must be small, light, and easily applied. Each soldier in the United States Army carries an individual sealed first-aid packet which is for his own personal use.

Contents of United States Army First-aid Packet.

Printed slip of directions	1
Gauze bandages 4 × 84 inches	2
Gauze compresses, one sewed to each bandage	2
Safety-pins	2

In the army packet the gauze is sewn to the bandage so that it may be applied to the wound without being handled. The gauze and bandages are both impregnated with a solution of bichloride of mercury.

The Hospital Corps of the Army, that is, the enlisted personnel of the sanitary troops, carry a first-aid pouch which is much more complete and which is for the use of the members of the Hospital Corps in applying first aid before the injured soldier is seen by the surgeon.

United States Army Hospital Corps First-aid Pouch.

Compressed gauze bandages	6
Gauze compresses (½ yard)	4
Individual first-aid packets, as above	10
Iodine swabs	1 dozen
Common pins	¼ paper
Safety-pins	1 dozen
Adhesive plaster, 5 yards by 1 inch	1 spool
Aromatic spirits of ammonia	1 flask
Cup	1
Tourniquet, field	1
Dressing forceps	1
Scissors	1
Lead-pencil	1
Diagnosis tags	1 book

The purpose of this packet is to supply the necessary equipment for first aid such as is commonly required on the field and, at the same time, not to overload the attendant with seldom-needed supplies.

For household use considerable latitude may be allowed in the selection of supplies. The following has been suggested as inexpensive, and at the same time fulfilling all ordinary requirements:

Household First-aid Outfit.

Bandages, assorted sizes	3
Sterile gauze	1 yard
Cotton	$\frac{1}{4}$ pound
Tincture of iodine (one-half strength)	1 ounce
Carron oil, for burns	4 ounces
Aromatic spirits of ammonia	1 ounce
Adhesive plaster (1 inch by 5 yards)	1 roll
Clinical thermometer	1
Safety-pins	1 dozen
Vaseline	1 bottle
Boric acid (powdered)	2 ounces

In a household set of this sort almost any of the household remedies may be added, such as castor oil, Epsom salts, soda-mint tablets, alcohol, witch-hazel, hot-water bag, ice-cap, syringe, etc. It is advisable to prepare such an outfit as the above and keep it always complete and available for emergency use.

Numerous first-aid kits have been prepared by the surgical supply houses. Burrows, Wellcome & Co. prepare small cases which are made very compact by the use of compressed cotton and gauze, and medicine put up in collapsible tubes. A simple one called the "Boy Scout's First-aid Case" contains aromatic spirits of ammonia, boric acid ointment, carron oil, bandages, dressings, collodion, pins, and adhesive plaster. Larger and more complete sets may be secured from dealers.

It is desirable that any outfit for general use should be made as simple as possible, so that it may be used, and used correctly, by whoever happens to be present when the emergency arises. When special training is given to attendants who are constantly present, as in factories, shipyards, and the like, the more complete outfits are to be preferred.

THE ORGANIZATION OF FIRST AID.

In the development of first aid in schools, colleges, and in industrial organizations the formation of first-aid squads has recently been advised and, in some locations, most carefully carried out. The systematic study of emergency treatment, together with the feeling which each member of the squad has that he is taking an active part in first-aid work and not merely studying the subject in the abstract, has given a decided stimulus to the entire subject. In addition, the increasing interest in first aid has led to interest in sanitation and personal hygiene, with consequent improvement in health.

In practice, four men usually constitute a "first-aid squad." One man is appointed captain and the other three assistant workers. They study the general problems of first aid, and at the same time the particular problems of the school or factory in which they work. They also study "team work," two of the assistants carrying the stretcher and the third carrying the first-aid packet. Each man knows his place and takes it without special instruction. In addition, each man is trained to occupy the position of captain, or any other position which may become vacant.

In order to stimulate interest and competition, certain companies have had first-aid meets, into which the first-aid squad enter with all the zest of a college student at an athletic meet. Problems in first aid are given and prizes given to the squad whose performance is nearest perfect, the marking being done on the basis of speed, skill, and judgment. After a little practice, and with a groundwork of the principles of first aid, it is remarkable how skilfully uneducated workers will tackle original problems in first aid; for example, the removal of a patient with a fractured leg from a deep excavation or the carrying of an unconscious man from the roof of a high building.

This phase of the subject, which has been largely neglected except in the army and the navy, deserves a more prominent place in civil life. The institution of the study of first aid and the development of the practice of first aid by the formation of first-aid squads is earnestly recommended for schools, stores, factories, and elsewhere, where large groups of individuals are brought together.

CHAPTER II.

ANATOMY AND PHYSIOLOGY.

For a proper understanding of the principles of first aid it is necessary to have some knowledge of the elements of normal anatomy and physiology. The better the normal workings of the body are understood, the easier it will be to apply the appropriate treatment for a given injury.

THE BONES.

In ordinary first-aid work only a general working knowledge of anatomy is required. For purposes of description it is necessary to designate the various bones by special names, but it is only required that the student have a general understanding of their size and location, without attempting to learn their anatomical names.

The Skeleton.—The bony framework of the body, taken as a whole, is known as the skeleton. The bones serve to give attachment to the muscles and act as a support for the body and as an aid to locomotion. They also serve to protect the delicate organs from external injury. Thus, the brain is protected by the skull and the heart and lungs by the ribs. They also serve as an aid and support for most of the voluntary actions. For instance, if the hands and arms contained no bones all of the ordinary movements would be difficult or impossible. On the other hand, most of the involuntary movements of the body, such as the heart action and the digestion, go on without the direct aid of the skeleton.

The skeleton is divided, for purposes of description, into the head, the trunk and the extremities.

The Head.—The head is made up of the cranium and the bones of the face. The cranium is a firm bony case

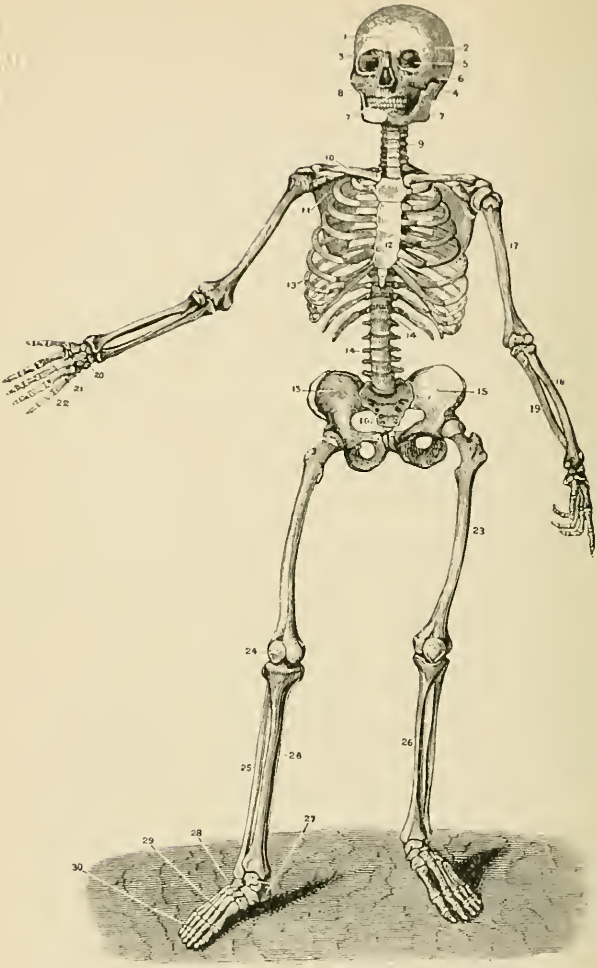


FIG. 2.—Front view of the adult skeleton: *1*, frontal bone; *2*, parietal bone; *3*, nasal bones; *4*, occipital bone; *5*, orbit; *6*, malar bone; *7*, *7*, upper and lower maxillæ; *8*, nasal cavity; *9*, cervical vertebræ; *10*, clavicle; *11*, scapula; *12*, sternum; *13*, ribs; *14*, *14*, dorsal and lumbar vertebræ; *15*, *15*, innominate bones; *16*, sacrum; *17*, humerus; *18*, radius; *19*, ulna; *20*, carpus; *21*, metacarpus; *22*, phalanges of hand; *23*, femur; *24*, patella; *25*, fibula; *26*, tibia; *27*, os calcis and astragalus; *28*, cuneiform and cuboid bones; *29*, metatarsus; *30*, phalanges of toes.

which protects the brain. It consists of several flattened bones, forming when united a strong protective covering, completely enclosing the delicate tissues of the brain. The

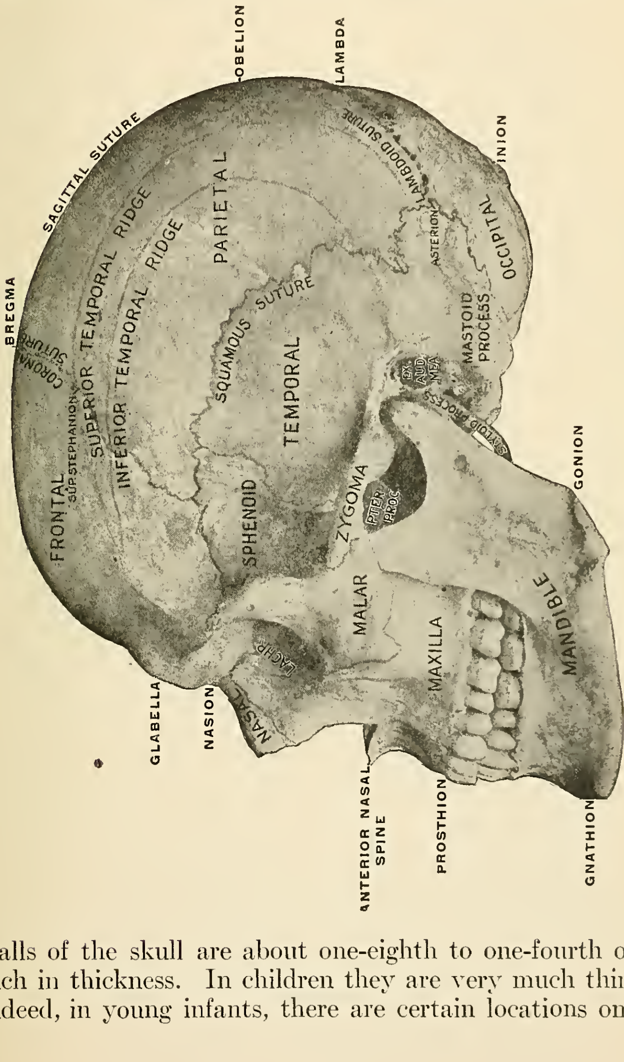


Fig. 3.—Human skull viewed from left side. (Cryer.)

walls of the skull are about one-eighth to one-fourth of an inch in thickness. In children they are very much thinner, indeed, in young infants, there are certain locations on top of the head where the skull is very thin and membranous in character, having not yet undergone bony change.

In the anterior portion of the head is the face, formed by several small bones which together act as a bony framework for the nose, cheeks, and jaws, while the forehead, on the other hand, is formed by a portion of the skull. It is important to remember this relation because, in injuries to the forehead, we may expect an associated fracture of the skull

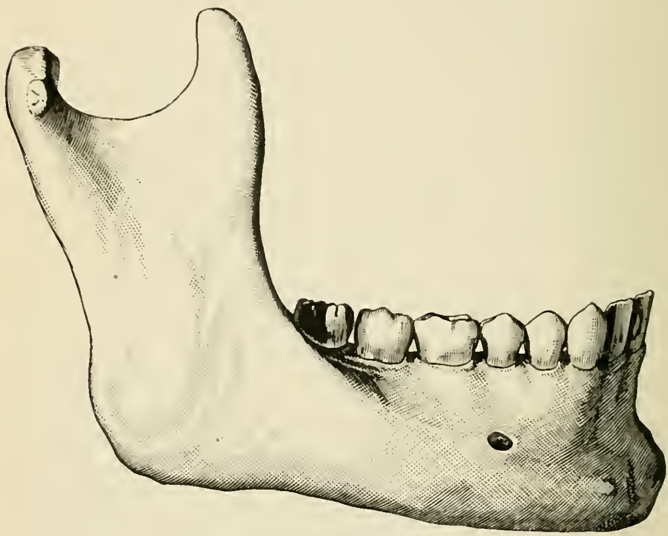


Fig. 4.—Side view of the lower jaw. (Gray.)

and an injury to the brain, while in injuries to the portion of the face below the eyes, coincident brain injury is uncommon.

The upper teeth are located in the maxilla, or upper jaw, and the lower teeth in the mandible, or lower jaw.

The Mandible.—This bone, sometimes called the inferior maxilla, sometimes referred to simply as the jaw bone, is the only bone of the face which is movable. It moves freely on two joints which are situated in the skull just in front of the ears, and its motion is limited chiefly to an up-and-down hinge-like action.

The Trunk.—The trunk consists of the spinal column, the ribs, and the pelvis.

The Spinal Column. — The spinal column extends from the skull to the pelvis, and serves as the bony framework of the neck and as the main support of the chest and abdomen. It is formed by twenty-four irregularly shaped disk-like bones (vertebræ), which are very strong, and serve for the attachment of the strong muscles of the back and as a protection for the spinal cord, which runs through a canal formed by the openings in the center of the disk-like bones, the spinal canal. The bones of the spine may be felt in the middle of the back, running from the skull to the pelvis.

The Ribs. — These are flat ribbon-shaped bones, twelve on each side, curving from the spine to the breast bone in front. They enclose the heart and the lungs in the cavity of the chest. They are thin bones, and comparatively easily broken, moving slightly with respiration.

The Pelvis.—At the lower end of the spine is a firm bony

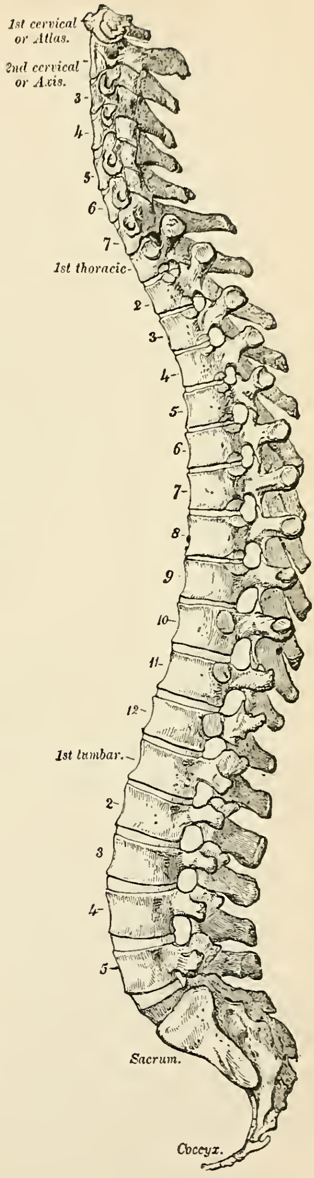


Fig. 5.—Lateral view of vertebral column. (Gray.)

case which contains the bladder, the rectum, and the organs of generation. This is the pelvis, and is formed of large heavy bones, which, besides serving as a protection for the contained organs, must bear the weight of the body. The pelvis is larger above than below, the flaring upper edge being felt at the sides just below the waist line. Two strong processes which project downward serve to support the body while sitting, while on the outer side of the pelvis are two large joint cavities which articulate with the large bones

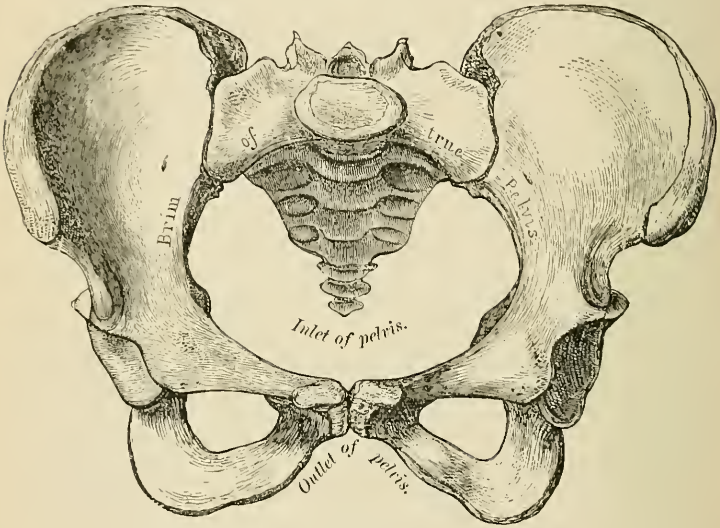


Fig. 6.—Bony pelvis from above. (Gray.)

of the thighs. In the back the pelvis is formed by a thick wedge-shaped bone, the sacrum, which bears the direct weight of the body transmitted through the spine.

The Upper Extremity.—The upper extremity consists of the clavicle, the scapula, the humerus, the radius, the ulna, and the small bones of the wrist and hand. (Fig. 2.)

The Clavicle.—The clavicle, or collar bone, is the bone that can be felt, as a cylindrical curved bone, at the front of the base of the neck. It extends from the upper part of the sternum, or breast bone, at its inner end, to the shoulder-blade, externally. This bone is frequently fractured.

The Scapula.—This is commonly called the shoulder-blade, and is the thin flat triangularly shaped bone that can be felt just back of the shoulder. When the shoulders are drawn back the scapulæ form wing-like projections, which are plainly evident in thin persons. At the outer angle is a hollow cavity which forms the shoulder-joint with the head of the large bone of the upper arm.

The Humerus.—This is the largest bone in the upper extremity, and is sometimes spoken of as the arm bone. It joins above with the shoulder-blade and below with the bones of the forearm. In adults this bone is usually an inch or more in diameter. It is frequently fractured.

The Forearm.—There are two bones in the forearm, the radius and the ulna. The radius is the heavier bone, and is located on the thumb side of the forearm. The ulna is a little longer than the radius and is the bone that forms the point of the elbow. It can be plainly felt just beneath the skin extending from the point of the elbow down to the inner side of the wrist. At the wrist the radius is on the thumb side, while the lower end of the ulna can be felt as a rounded prominence on the back of the wrist on the same side as the little finger. Both of these bones are frequently fractured.

The Carpus.—There are eight small bones in the hand which are crowded together in what is commonly called the wrist. Because they are so small and so crowded together it is very difficult to locate a fracture or dislocation of these bones with any degree of certainty.

The Metacarpus.—There are five elongated bones, one for each digit, called metacarpal bones. In general, they occupy the location of what is commonly called the palm of the hand.

The Phalanges.—Two shorter bones, similar in shape to the metacarpals, go to make up the thumb. They are called the phalanges. The one nearest the hand is designated as the proximal phalanx, and the one forming the tip of the thumb is called the terminal, or distal phalanx. In the fingers are found analogous bones, except that there are three phalanges in each finger. The phalanges of the fingers are sometimes called the first, the second, and third phalanges of the respective fingers, the first being the one nearest the hand. The metacarpal bones and the phalanges are frequently injured, both fracture and dislocation being very common.

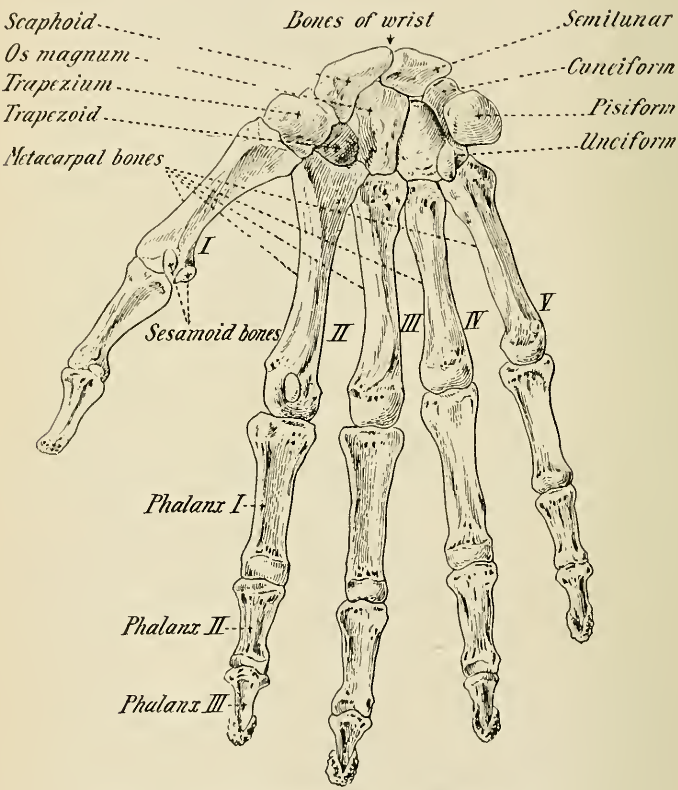


Fig. 7.—Showing detail of the bones of the hand.

The Lower Extremity.—The lower extremity consists of the femur, the patella, the tibia, the fibula, and the small bones of the ankle and the foot.

The Femur.—The large thigh bone is known as the femur. It is the largest and strongest bone in the body, and extends from the pelvis to the knee. The thigh, like the arm, contains only one bone.

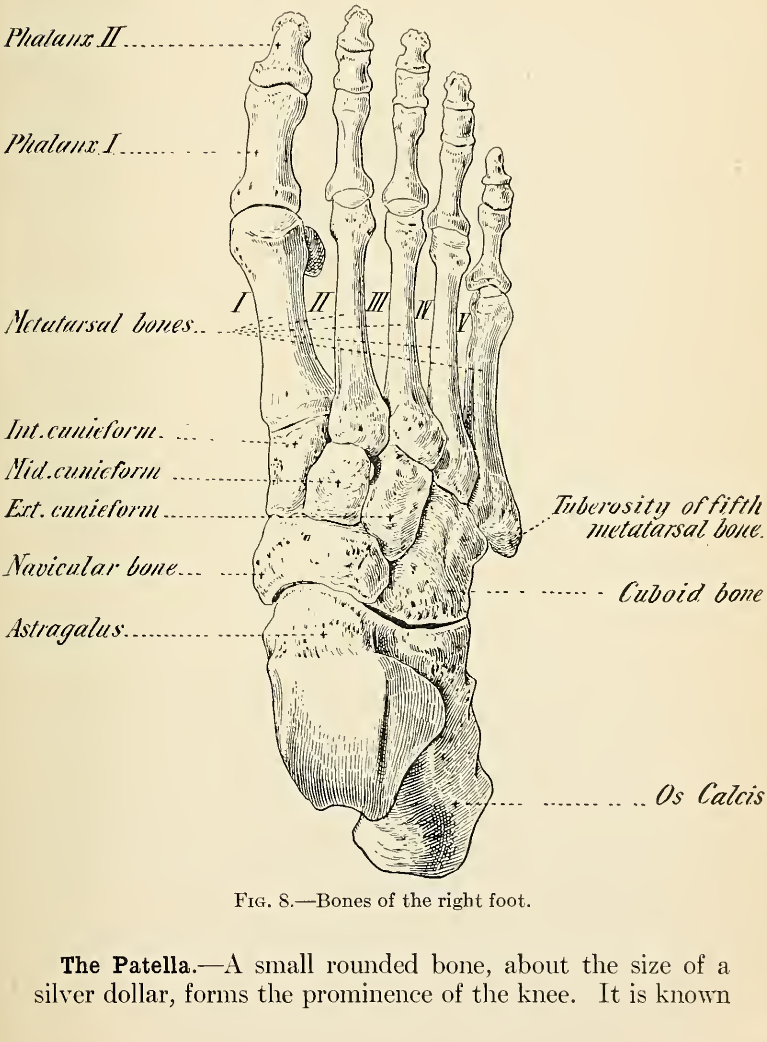


Fig. 8.—Bones of the right foot.

The Patella.—A small rounded bone, about the size of a silver dollar, forms the prominence of the knee. It is known as the patella, or knee-cap. It serves as an aid to the muscular action of the knee-joint. It can be easily felt beneath the skin. It is frequently fractured.

The Leg.—The bones of the leg correspond to those of the forearm. There is a large strong bone, the tibia, and a long slender bone, the fibula. The tibia is called the shin bone, and can be felt beneath the skin along the shin and at the inner side of the ankle-joint. The fibula is deeply situated in the muscles of the calf, and can be felt only at the upper end, on the outer side of the leg, just below the knee-joint, and on the lower end where it lies on the outer side of the ankle-joint.

The Tarsus.—There are seven small irregularly shaped bones of the foot which correspond roughly to the bones of the carpus. In the foot one of these bones, the *os calcis*, is especially well developed, forming the heel.

The Metatarsus.—This corresponds to the metacarpus in the hand. The metacarpal bones occupy that portion of the foot between the midpoint of the foot and the base of the toes. They are five in number.

The Phalanges.—The phalanges of the foot are analogous to those of the hand, but are smaller and less well developed.

Fractures of the lower extremity are less common than those of the upper extremity but they are sufficiently common to be of considerable interest to the first-aid worker.

THE JOINTS.

The bones are joined together by strong fibrous bands called ligaments. Where the bones move on each other there is formed a joint or articulation. In some cases the bones are joined so firmly that there is no motion, as in the bones of the skull and in the pelvis. In other cases there is only slight motion, as in the spine and the ribs, while in other joints the motion is very free, as in the shoulder and in the hip. Where motion is possible in all directions the joint is known as a ball-and-socket joint. In other cases motion is possible in only one plane, such as at the elbow and the knee-joint. Such a joint is known as a hinge-joint.

Many of the joints are technically regarded as hinge-joints, although they have a small amount of lateral motion.

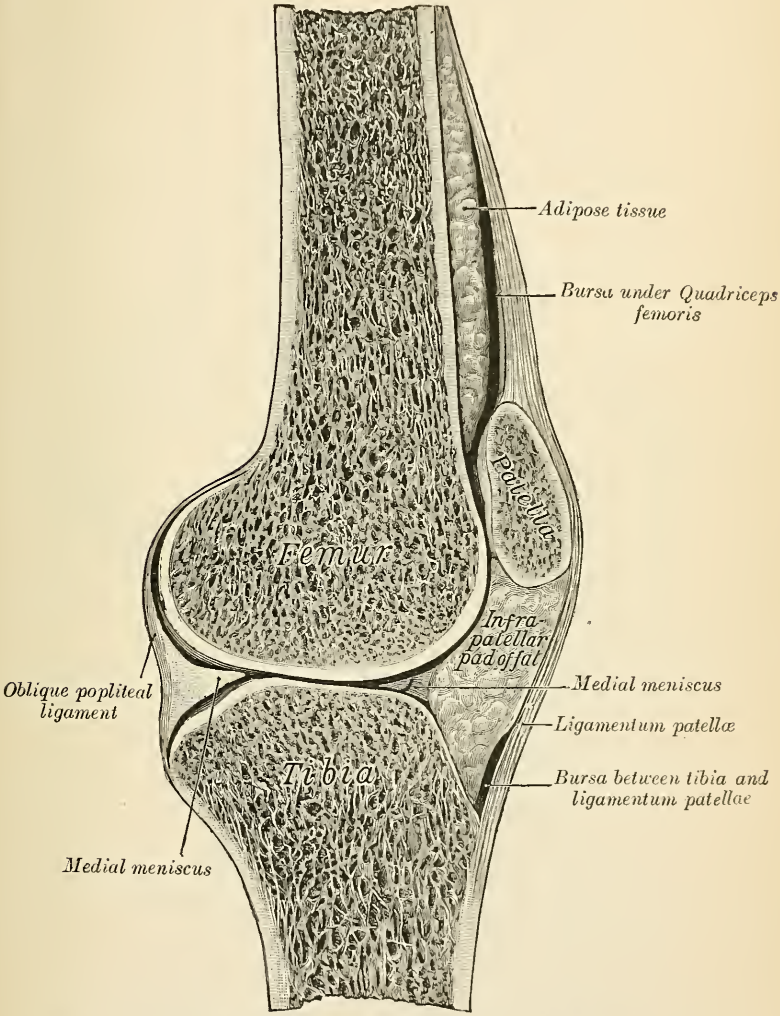


Fig. 9.—Longitudinal section of the knee-joint showing ligaments, joint cavity and knee-cap. (Gray.)

Each joint is lined with a thin membrane called synovial membrane, which secre es a serous fluid. The purpose of this fluid is to act as a lubricant for the movement of the joint. When the synovial membrane becomes inflamed the the condition is known as synovitis.

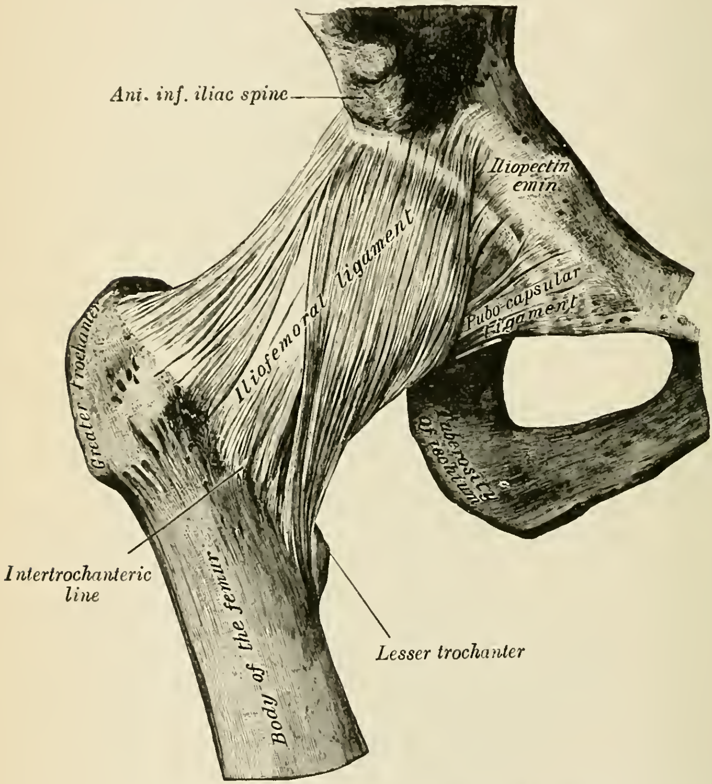


FIG. 10.—Right hip-joint from the front with muscles entirely removed, showing the strong capsule thickened in front to form the iliofemoral ligament. (Gray.)

The ligaments are strong, fibrous bands passing across the joint, and, being attached to the bones on either side of the joint, serve as restricting bands. In some joints they are

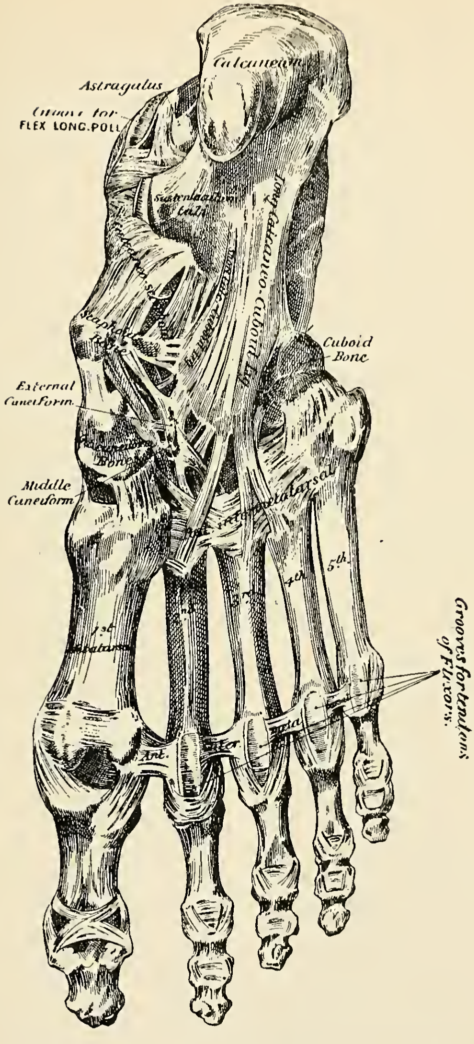


FIG. 11.—Sole of the foot with muscles removed, showing strong ligaments which hold the bones together and support the arch of the foot. (Allen.)

very firm, allowing little or no movement, while in other locations they must be very lax to allow the joint to move freely. If you attempt to bend the terminal phalanx of the finger to the side it is found to be firmly held in place. That is because the lateral ligaments are comparatively short and strong. When the same phalanx is moved in the other direction the movement is fairly free, being limited only by extreme flexion or extension. Consequently it is apparent that the ligaments on the front and back of the phalanges must be long and lax.

In some joints, such as the small joints of the ankle, all the ligaments are short and strong, so as to give a firm support and allow very little movement, while in other joints, for example the shoulder, free movement in all directions is permitted by the fact that all the ligaments are long and lax. In the shoulder most of the support is obtained by the strong muscles which pass across the joint rather than by the ligaments which offer almost no support to the ordinary joint movements.

When the joint is bent so as to decrease the angle between the bones the movement is known as flexion, and the joint is said to be flexed. Movement in the opposite direction is extension of the joint.

When the movement of the joint is such as to carry a portion of the body away from the midline the movement is known as abduction, while the opposite movement is adduction.

THE MUSCLES.

The bones are controlled by muscles which constitute the flesh of the body. Each muscle is made up of a fleshy portion, consisting of contractile muscle fibers, on either end of which is a fibrous tissue band known as the tendon. Tendons may be short and broad or may be long narrow bands several inches in length. The ends of the tendons are attached to the bones and are usually so arranged that they pass over a joint. As it is possible to contract the muscle at will, it can be seen that the contraction of the muscle will cause voluntary movement of the corresponding joint.

In the human body the processes are so complex that even the simplest movements are usually the result of the coördinated

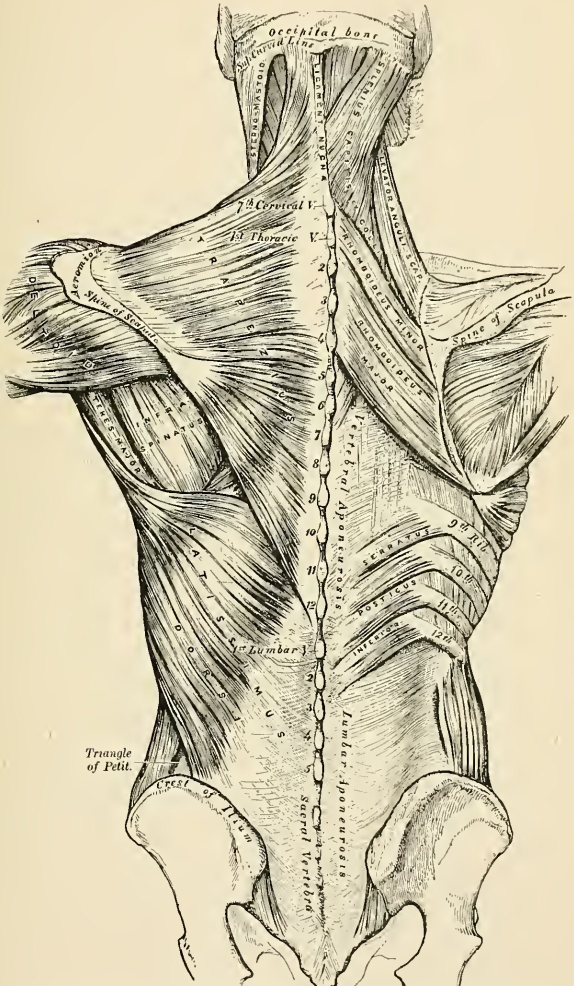


Fig. 12.—Muscles of the shoulders, neck and back. On the right side the outer layer of muscles has been removed. (Gray.)

action of several muscles. A rough idea of the number and variety of the muscles of the body may be obtained from the illustrations (Figs. 12 and 13), which show only a part of the muscles of the back and arm.

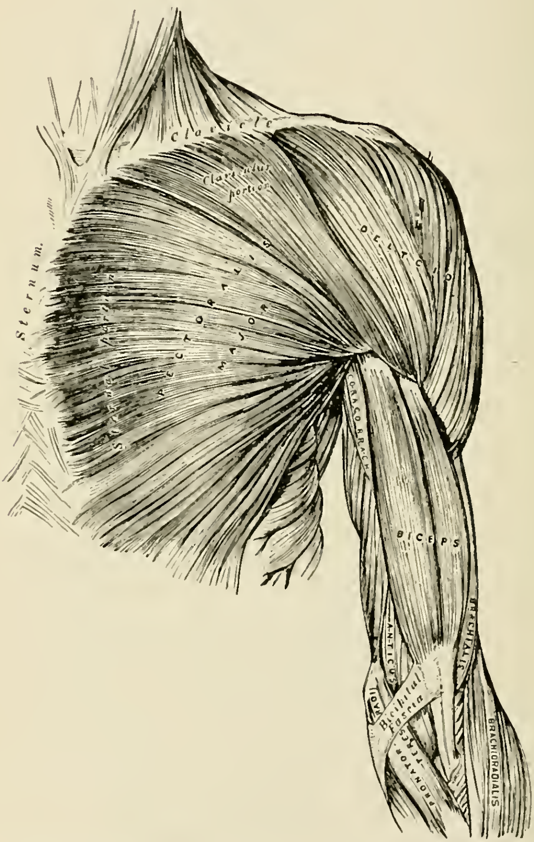


FIG. 13.—Superficial muscles of left side of chest and upper arm. (Gray.)

In some cases the long tendon attached to a muscle allows it to act on a bone some distance from the body of the muscle. For example, the fingers are bent by a muscle of the forearm which acts by means of four long tendons, which extend from above the wrist to the distal phalanx of the fingers. The tendinous portion of the muscle has no contractile properties; it acts merely as a band which transmits the pull from the muscle to the bone.

As muscles act only by contraction, it follows that they can do work only through their pulling action. Thus one group of muscles flexes a joint while another group extends it. These two groups are said to oppose each other. Where one group of muscles is in action, the opposing group is relaxed.

The muscles surround the bones throughout the greater part of the body, and, in turn, are covered by the superficial fat and skin, giving form to the body. The tendons may be deeply located, surrounded by muscles and fat, or they may be close to the skin. On the back of the hand the tendons which extend the fingers are very superficial. They may be easily felt moving beneath the skin when the fingers are extended.

The muscles described above are called voluntary muscles because they are under the control of the will. In addition to these there is in the body another type, involuntary muscles, which act independently, and are not subject to control. Involuntary muscles are found in the heart, the stomach, the intestines and in other internal organs.

They are of the utmost importance in the vital functions of the body, but take no part in locomotion, or other voluntary movements. They exist in a diffuse layer in the walls of the contractile organs but differ from voluntary muscles in not being grouped into bundles forming distinct muscles and in having no tendinous attachments.

THE BLOOD AND CIRCULATION.

The Blood.—The blood is a fluid tissue which circulates through the bloodvessels, permeating, by means of the smaller capillaries, all parts of the body. Its chief function is to carry oxygen and nourishment to the cells of the entire body and to remove the carbon dioxide and other waste products which result from cellular activity.

It is composed of a clear straw-colored fluid, the plasma, in which float numerous small red cells that give to the blood its red color.

The red blood corpuscles number approximately 5,000,000 to each cubic millimeter of blood and their chief function is the carrying of oxygen from the lungs to the body tissues. If, as a result of hemorrhage or other cause, their number falls greatly below normal, the patient is said to be anemic. If the blood corpuscles become too few in number life ceases.

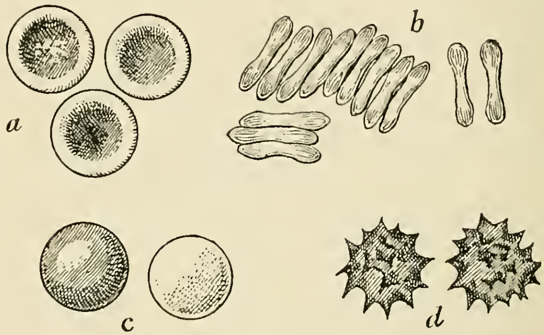


Fig. 14.—Human red blood corpuscles. Highly magnified. *a*, seen from the surface; *b*, seen in profile and forming rouleaux; *c*, rendered spherical by water; *d*, rendered crenate by salt solution. (Gray.)

In addition to the red blood corpuscles, there are other corpuscles found in the blood which are colorless and are called leukocytes, or white blood corpuscles. These are less numerous than the red, the average number being 5000 corpuscles per cubic millimeter. The leukocytes are chiefly concerned in the protection of the body against infection. They migrate through the walls of the bloodvessels and attack bacteria which invade the body, for this reason being sometimes called phagocytes.

When blood is allowed to stand outside the vessels of the body, it divides itself into two portions, a thick spongy part which is known as the clot and a clear straw-colored fluid which is called serum. This change is very important, as it is this process of coagulation, or clotting, which takes place when small bloodvessels are cut, the clot forming a plug which stops the hemorrhage.

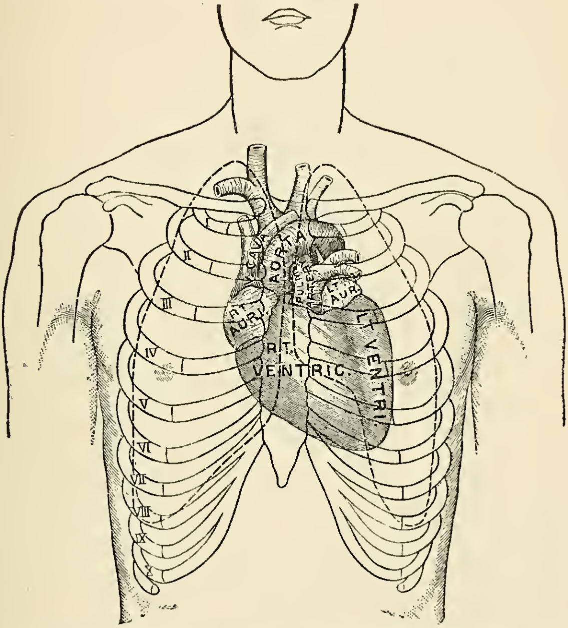


FIG. 15.—Diagrammatic sketch showing heart and the beginning of the large vessels in their position in the chest. (Hare.)

The Heart.—This is a large muscular organ which pumps the blood through the bloodvessels, thus forming the circulation. The heart is located in the left side of the chest, where its beat can usually be felt a few inches below the left nipple. It is about the size of a man's fist. It is divided longitudinally into a right and left side, each of which contains two cavities, one called the auricle and the other the ventricle. The auricle on the right side is connected with the ventricle on the right side by an opening, guarded by valves which permit the blood to pass into the ventricle but do not allow it to be forced back again into the auricle. There is a similar opening between the left auricle and left ventricle, guarded by a similar valve. There is, however, no opening between the right and left sides of the heart. From the right ventricle the blood is forced into the pulmonary artery, and from the left ventricle into the aorta. The mouths of both of these arteries are guarded by valves which allow the blood to pass from the ventricles into the arteries, but will not permit it to flow in the reverse direction.

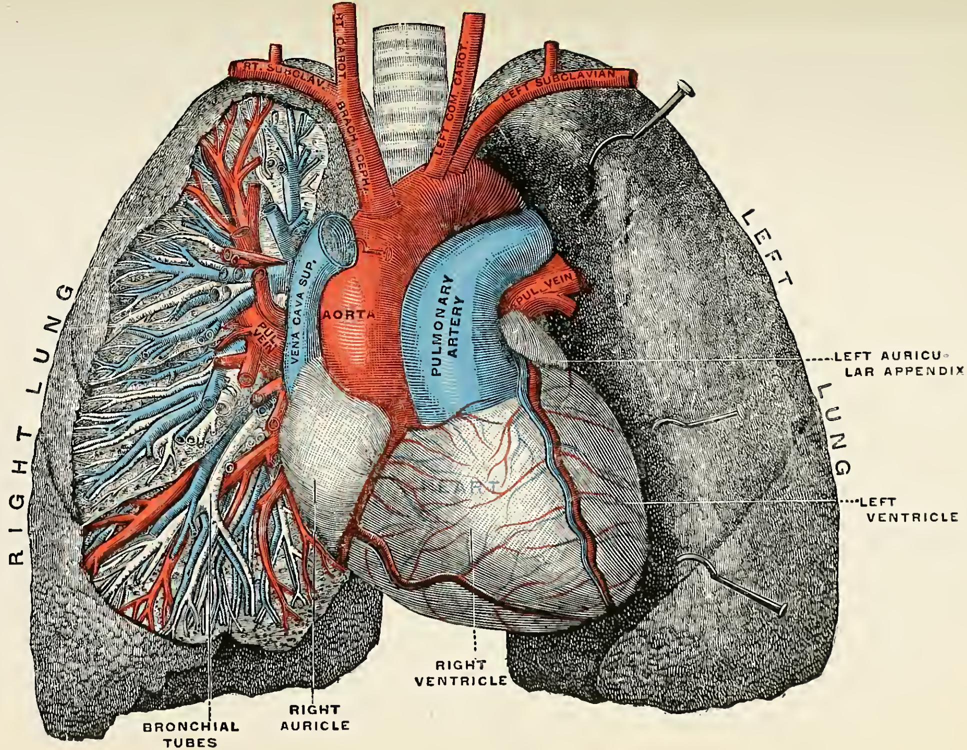
The adult heart contracts about seventy-two times per minute in the average person. In thin persons its beat may often be easily felt at the location of the apex of the heart, which is about two inches below and a little to the left of the left nipple. In stout persons, and in women who have large breasts, it can be felt just below and to the outer side of the left breast. However, in many persons it is impossible to detect the beat by means of touch, so that this sign is of limited aid in determining the action of the heart.

If the ear is applied to the chest in this region the examiner can hear, with a little practice, the dull, muffled sounds made by the contraction of the heart, and can, if necessary, count the beats as they occur.

However, for most practical purposes, the rate of the heart's action is taken from the pulsation of the radial artery at the wrist, to which the impulse of the action of the heart is transmitted through the bloodvessels. Consequently, we can count the beats at the wrist where the pulsation is termed the pulse, and we speak of the pulse as being seventy-two beats to the minute in the average adult.

In young children the pulse-rate may be much faster, a pulse-rate of 100 in a baby not being uncommon. In nervous individuals very slight causes may be sufficient to send the pulse to 100 or even considerably higher.

The Arteries.—When the blood leaves the heart it passes into large musculofibrous tubes, which divide into smaller tubes; these in turn divide and subdivide into still smaller tubes, like the trunk and branches of a tree. These tubes are called arteries and serve to carry the blood away from



Showing heart, lungs, and large vessels. The front of the right lung has been removed to show the division of the vessels inside the lung. (Gerrish.)

the heart. The largest artery, the aorta, gives off branches soon after it leaves the heart, which pass up on each side of the neck to supply the corresponding sides of the neck and head. A little farther along a large artery is given off to

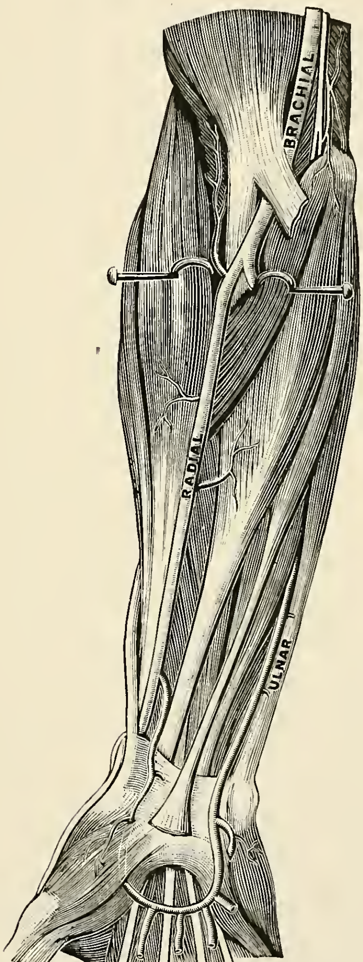


FIG. 16.—Showing the deep arteries of the forearm. (Gerrish.)

supply each upper extremity. These large arteries pass down each arm, giving off smaller branches to supply the shoulder and arm, to the elbow, where they divide into two arteries, the radial and the ulna. It is the radial artery which can be felt pulsating at the wrist.

After the aorta has given off the large branches to the head and arms it passes downward through the chest to the abdomen, where it divides into two large branches, which pass to the two lower extremities. In the chest and abdomen the aorta and its large subdivisions give off large and small branches to supply the chest and the abdomen. In the thigh the single large artery passes downward to about the region of the knee, where it divides into two smaller arteries.

The arteries usually run deeply situated in the tissues, but in a few places they may be fairly close to the skin. When close to the skin or under observation in a wound they may be seen to pulsate, and if cut the blood spurts from them in bright red jets.

While the location of the arteries is fairly constant they are subject to some variation. In general it may be said that the smaller the artery the more apt it is to vary in its location. It is not uncommon for the radial artery to be situated a considerable distance from its normal location in the wrist. In such cases the examiner is sometimes led astray, believing the patient to be pulseless when the true condition is that the abnormal position of the artery makes it difficult or impossible to locate.

The walls of the arteries are thick, strong, and elastic. They stand open when cut, in contradistinction to the veins, which are soft and flaccid, and collapse unless filled with blood.

The Capillaries.—As the arteries divide and subdivide they continually grow smaller, forming very small arteries, the arterioles, which in turn divide into minute thin-walled vessels, the capillaries. The walls of these minute vessels are so thin that the exchange of oxygen from the blood for the carbon dioxide and waste products of the tissue cells easily takes place. The minute network of the capillaries passes to every portion of the body, so that even the slightest scratch injures many of these small vessels.

The Veins.—The capillaries join together, forming larger vessels which are termed veins. These veins again join to form still larger veins, finally forming the large veins of the extremities and other portions of the body, which empty into the still larger veins of the trunk, finally emptying into the right auricle of the heart. The veins are less constant in their location and size than are the arteries, and do not pulsate. They are divided into two groups according to their location, the superficial, and deep, veins.

The deep veins, as a rule, accompany the arteries, the blood flowing in the opposite direction. Usually two veins accompany each of the larger arteries.

The superficial veins run in the subcutaneous tissue. In thin persons they can be easily made out just beneath the skin. Because they lie so close to the skin they are frequently injured by comparatively slight wounds. The blood in the veins flows in a steady stream, and is darker in color than that in the arteries.

When either an artery or a vein is divided, bleeding usually occurs from both the proximal and distal portions of the injured vessel.

The Circulation.—The flow of blood forms a complete circuit. Beginning at the right auricle, where the venous blood enters the heart, it passes into the right ventricle, which contracts, forcing the blood through the pulmonary artery to the capillaries in the lungs, where it gives off carbon dioxide and takes up oxygen. The capillaries of the lungs join together to form the pulmonary veins, through which the now oxygenated blood passes to the left auricle. From the left auricle the blood passes to the left ventricle, which contracts and forces it into the aorta, and, through the aorta, to all the smaller arteries and finally to the capillaries, where the interchange between the blood and tissues takes place. The blood passes on through the capillaries into the veins, which finally carry it back to the right auricle, and the circuit is completed. This process is repeated hundreds of times during the day.

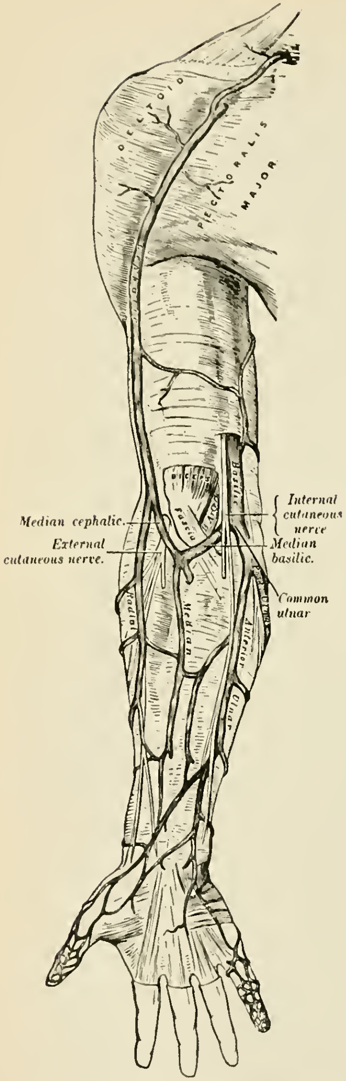


Fig. 17.—Front view of the superficial veins of the arm, forearm, and hand.

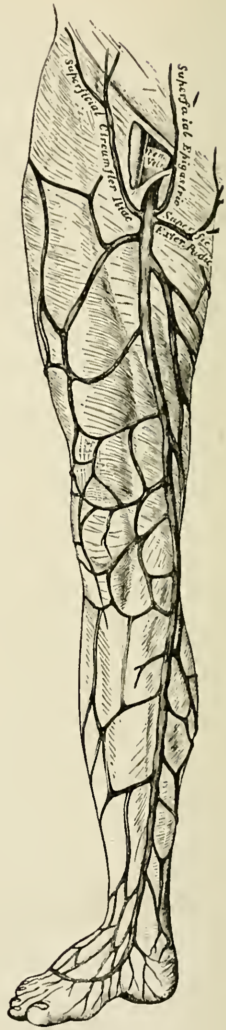


Fig. 18.—Superficial veins of the front and inner surface of the lower extremity. (Gray.)

PLATE II

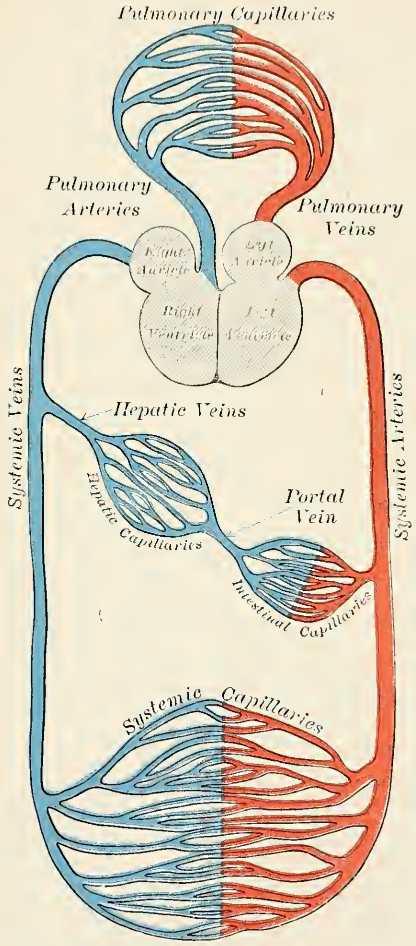


Diagram to Show the Course of the Circulation of the Blood.

The pulmonary capillaries are the small vessels of the lungs. The systemic capillaries represent those of the skin, head and extremities. The third system shown represents the capillaries of the intestines and liver.

THE NERVOUS SYSTEM.

All voluntary movements and many of the involuntary functions of the body are under the control of the nervous system. It is through the medium of the nerves that all the impulses arising outside of the body become sensory perceptions.

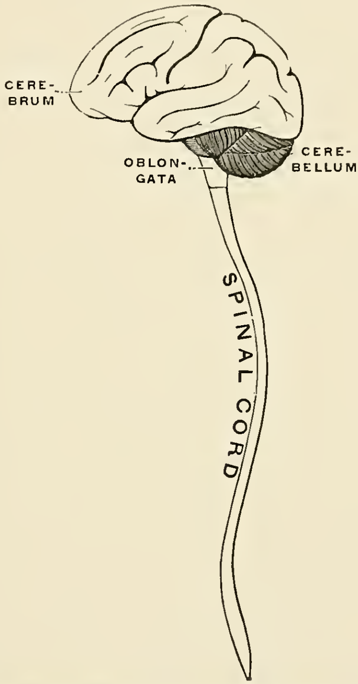


FIG. 19.—Diagrammatic sketch of brain and spinal cord. (Gerrish.)

Even the simplest voluntary movement, such as picking up a book or drawing a straight line, is the result of a great number of coördinate nerve impulses. The sensation of taste, smell, sight, and hearing are all due to impressions made upon the brain through the medium of corresponding nerves. The nervous system is divided into the brain, the spinal cord, and the nerves.

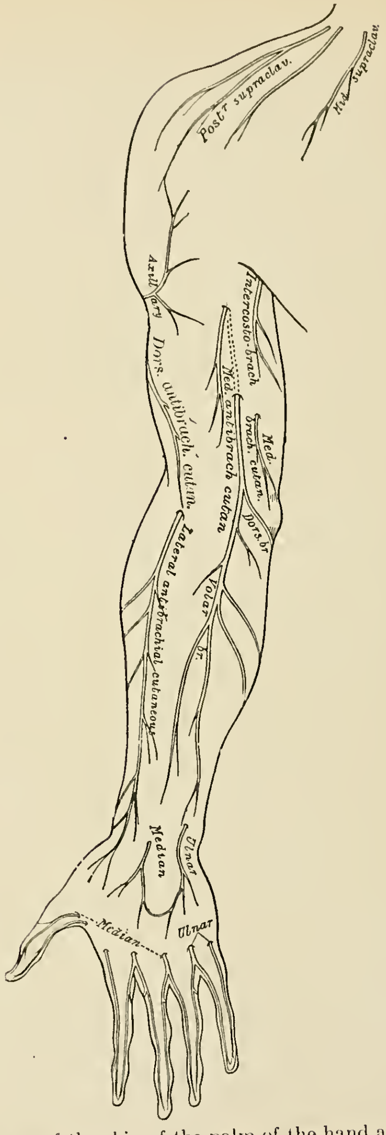


FIG. 20.—Nerves of the skin of the palm of the hand and arm. (Gray.)

The Brain.—This large solid organ, located in the skull, is the seat of the mind and the origin of voluntary impulses.

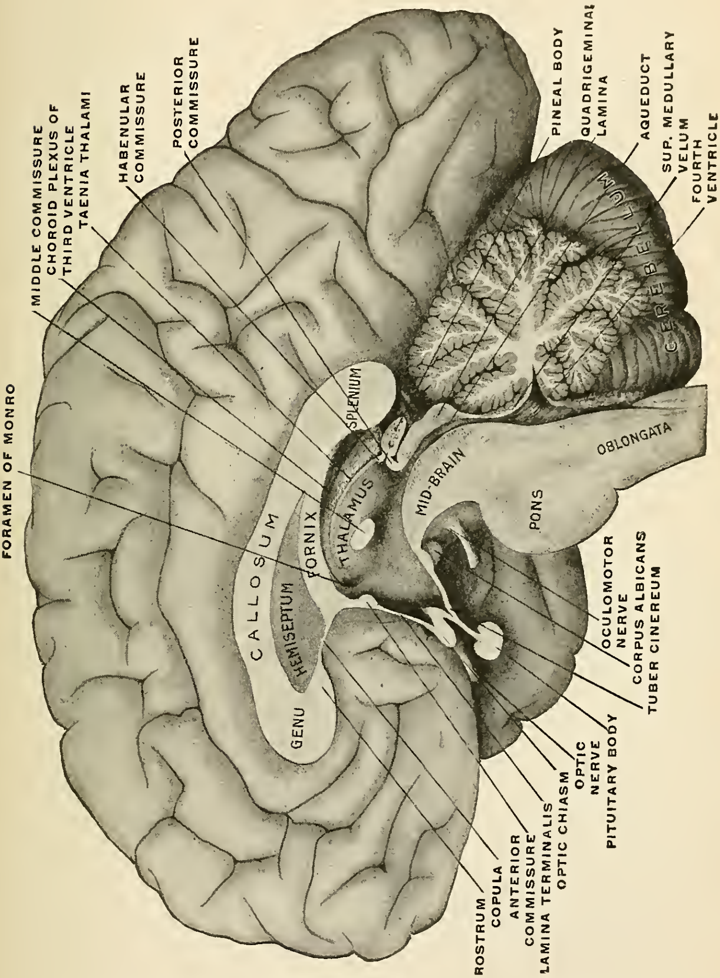


Fig. 21.—Showing the details of the brain. The brain is shown cut vertically in the midline from before backward.

It is made up of cells and nerve fibers. Any injury to the brain is serious because it may interfere with the mind or with the ability to perform voluntary actions. Certain centers which control vital functions, for example, respiration, are located in the brain. If such a center is injured death follows as an immediate result. The brain is composed of the cerebrum, which is the larger portion, and is located above and anteriorly, and the smaller portion, the cerebellum, which is posterior and below.

Just below the cerebellum is a prolongation of the brain in the shape of a truncated cone, the base being continuous with the brain and the apex with the spinal cord. This is the medulla oblongata, and in it are found the vital centers for the control of respiration and the action of the heart.

The Spinal Cord.—Passing from the lower end of the medulla and continuous with it is the spinal cord, which is about the size of, or a little larger than, a lead-pencil. It is composed of nerve fibers and cells. It is located in the canal which is formed by the openings in the vertebræ, the spinal canal, and gives off fibers which go to make up the peripheral nerves, the fibers branching off the spinal cord and passing outward through the spaces between the vertebræ.

The Nerves.—Arising both from the brain and the spinal cord are nerve fibers which form the peripheral nerves. They are grouped together in bundles, which vary in size from the minutest microscopic fibers to bundles of fibers as large as the little finger. These nerve bundles are called the peripheral nerves, and the largest bundles are given special names. They divide and subdivide so that every portion of the body is supplied with nerve filaments. Nerves are of two general types, the sensory, which carry impulses from the periphery to the brain, and the motor nerves, which carry impulses from the brain to the muscles. Most large nerves contain both motor and sensory fibers.

The Action of the Nerves.—This is usually very complicated even for the simplest voluntary action. For the purpose of description the nerves may be likened to electric wires and the brain to the battery. A nerve impulse originated in the peripheral ending of a sensory nerve is transmitted to the brain, where it is transformed to a motor impulse, and this motor impulse is transmitted to a muscle which contracts, resulting in motion. If, for example, the

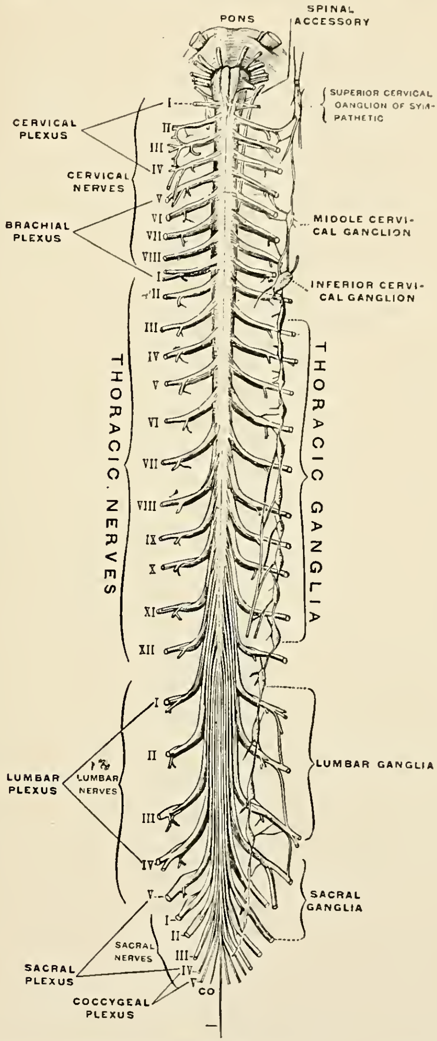


Fig. 22.—Spinal cord showing nerve roots. (Gerrish.)

hand is burned the sensation is transmitted at once to the brain and the proper motor impulse started which results

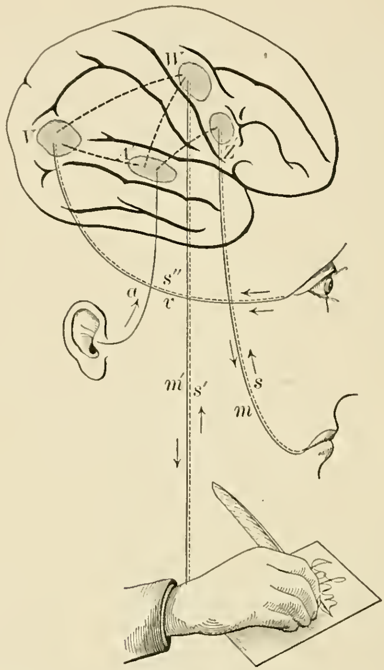


FIG. 23.—Diagrammatic sketch showing the course of a nerve impulse. *V*, visual center; *A*, auditory center; *W*, writing center; *Z'*, vocal center; *a* and *v* are sensory fibers conducting sound and visual perception; *s*, *s'* and *s''*, are sensory nerve fibers from the skin of the mouth, hand and eye; *m* and *m'* are motor fibers to the mouth and to the hand. The nerve impulse may be traced as follows: The object is seen and the impulse carried to the visual center and transmitted to the writing center which starts the impulse to the hand which, under the action of the impulse, writes the word. In the same way the name of the object seen may be spoken; or the impulse may start by a sense of touch or hearing and result in any form of voluntary action.

in the hand being drawn away from the hot object. This is done so quickly that it appears as though the action and the sensation occurred simultaneously, but, as a matter of fact, there is an appreciable time elapsing between the moment the sensation originates and the movement of the hand.

If the impulse is interrupted at any point the nerve reaction will be without result. Thus, if the sensory nerve going to the hand has been cut, the hand may be severely burned without any sensation being felt. If the sensory nerve is intact, but the motor nerve is cut, the burn is felt, but there is an inability to withdraw the hand.

The sensory impulse may arise as a result of one of the special sensations. Thus we shut the eyes when a bright light is flashed in them, and we jump when a loud noise is heard.

While the brain is the seat of all conscious action, consciousness is not essential to reflex action. The foot is withdrawn when pinched or pricked with a pin, and the eye is closed tightly when touched with a feather, even in people who are unconscious or asleep. This is known as a reflex act. The deeper the sleep or state of unconsciousness the less marked are these reflex acts. Thus, when a patient is anesthetized the fact that there is a reflex closure of the eye on lifting the lid and touching the eyeball is a sign that the patient is not deeply anesthetized. In the same way the closure of the lid and the reaction of the pupil to the action of light may be used to indicate the degree of unconsciousness following injury.

In addition to the peripheral nerves just described there exists in the body a secondary system, nerves which arise in nerve centers located chiefly in the chest and abdomen, the sympathetic system. Centrally, these centers are connected with the nerves leaving the spinal cord and distally they send fibers to the organs of the abdomen and chest and to the bloodvessels of the entire body.

While the action of the heart and the processes of digestion are to a certain degree automatic they are at the same time under the control of the sympathetic nervous system. Thus the mere sight of food is enough to cause salivation and the secretion of gastric juice, while an unpleasant sight may cause faintness and nausea.

The relation of the nervous system to the general physical condition will receive further consideration in reference to syncope and shock.

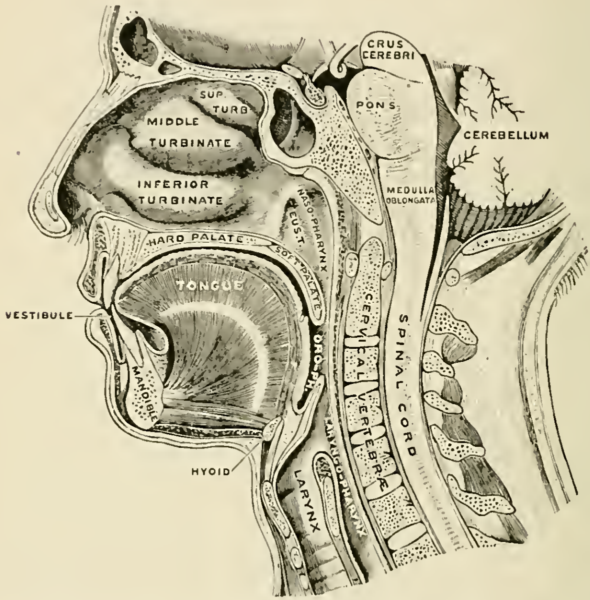


Fig. 24.—Section through the head and neck showing cavities of the throat and nose, beginning of the trachea, and the larynx. (Gerrish.)

THE RESPIRATORY SYSTEM.

The respiratory system consists of the nasal passages, the larynx, the trachea, the bronchi, and the lungs.

The Nose.—Air is admitted to the body through the nose, which consists of the external nose and the nasal passages. The nasal passages are two in number, separated by a thin partition, the nasal septum. In its passage through the nose the air is warmed and a certain amount of dust and other extraneous material is removed. If the air is dry it receives sufficient moisture in the nose to render it less irritating to the lungs.

The Larynx.—The air passes from the nasal passages through the throat into the larynx, which is situated at the beginning of the trachea. The larynx is located just behind the base of the tongue, and during the act of swallowing it is covered with a thin fibrous flap, the epiglottis, which prevents the entrance of food into the trachea. The larynx contains the vocal cords, which are instrumental in producing the voice.

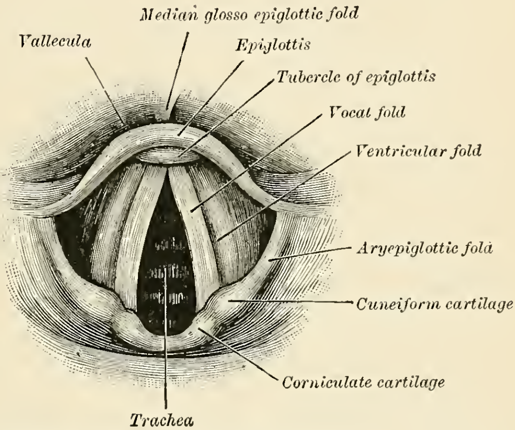


Fig. 25.—Showing larynx and vocal cords from above. (Gray.)

The Trachea.—Below the larynx is a firm tube-like structure, the trachea, which passes downward in the midline and can be felt in the lower anterior portion of the neck. The trachea acts as a passageway for the air between the larynx and the bronchi, and is about one-half inch in diameter and several inches long.

The Bronchi.—The trachea divides, in the upper part of the chest, into two similar though smaller tubes, one to each lung. These are the two main bronchi. These divide and subdivide into smaller bronchi, the smallest of which are termed bronchioles. In this manner the air is distributed to all parts of the lungs.

The Lungs.—The bronchi gradually become smaller, ending in minute air cells where the interchange of oxygen takes place between the inspired air and the blood. The minute air cell has a very thin wall which is in direct contact with the small capillaries of the lungs. The blood and air do not mix but the oxygen and carbon dioxide pass freely through the thin layer of membrane separating the two.

Respiration.—The air is drawn into the chest by suction. The ribs are raised and the flat fibromuscular diaphragm, which separates the chest from the abdomen, is drawn downward so that the cavity of the chest is enlarged and the air rushes in to fill the space, in the same manner as air rushes into the chamber of a pump when the piston is withdrawn. The lungs themselves act simply as inert sacs which expand as the air rushes in. This is called inspiration. The ribs now descend and the diaphragm moves upward and the air is forced out. This is called expiration. The combination of the two methods constitute the act of breathing or respiration. Both inspiration and expiration are controlled to a slight degree by the will. When respiration ceases for a period of more than two or three minutes, changes take place in the body cells that soon result in death. It is impossible to say how long respiration may cease before death occurs. Apparently reliable reports have appeared from time to time in which recovery has taken place after respiration has been absolutely absent for five minutes or longer. In most cases, however, cessation of respiration for more than a very short time, three to five minutes, results in death.

In health the rate of respiration varies from 14 to 24 per minute. In disease the rate may be as low as 8 and as high as 60. Both of these extremes indicate serious disturbances. In children the respiration-rate is more rapid, the normal being considerably higher than in adults. In cases of pneumonia it is not uncommon to see a child with a respiration of 60 or higher make a complete recovery.

Physiologically, the respiration is increased by exertion and the breathing of rarefied air, such as occurs in high altitudes.

THE ABDOMEN.

The lower half of the trunk is known as the abdomen. In it are found the organs of digestion, the liver, the spleen, and the kidneys.

The Alimentary Canal.—Digestion of food takes place almost entirely within the alimentary canal. It begins in the mouth and is continued in the stomach and the small and large intestines. The food is taken into the mouth, where it is broken up and mixed with the secretions of the salivary glands before it is swallowed. It then passes through a long tube, the *esophagus*, or gullet, to the stomach, where it is mixed with the gastric juice. The process of digestion is continued in the small intestine, and the nutritive products of digestion are absorbed through the walls of the small and the large intestines.

The Stomach.—The stomach is a musculomembranous sac holding about two or three pints and located in the upper part of the abdomen. The food remains in the stomach for a period varying from a few minutes to two or three hours before passing into the intestines. This fact is important, because in case of poisoning the poison may be almost entirely removed if the stomach is emptied during the half-hour immediately following the ingestion of the poisonous substance.

The food passes out of the stomach into the small intestine, which is a flaccid musculomembranous tube about twenty feet in length. This tube connects with a similar one about six or seven feet in length, the large intestine. The latter in turn ends in the rectum. During its passage through the small and large intestines the food undergoes further digestion and the digested material is absorbed, the food fibers and other indigestible portions of food remaining in the intestinal canal to be excreted in the process of defecation.

The Liver.—In the right upper portion of the abdomen is a large reddish-brown organ, weighing about three or four pounds, the liver. It is a solid organ made up almost entirely of liver cells, which secrete bile. Most of the blood carrying the absorbed products of digestion passes through the liver before it enters the general circulation. During its

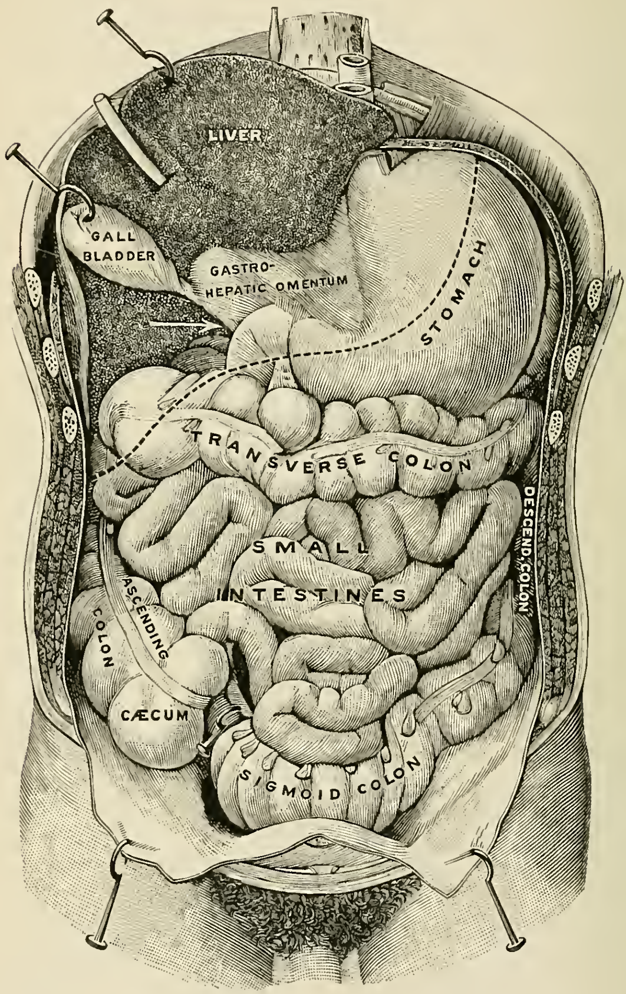


Fig. 26.—The front view of the abdominal contents. The liver has been lifted upward to show the stomach and gall-bladder. The large intestine (colon) may be seen running upward on the right side, then across the abdomen and downward on the left. (Gerrish.)

passage through the liver the blood undergoes certain chemical changes which are not very clearly understood but which are essential to life. In crushing accidents the

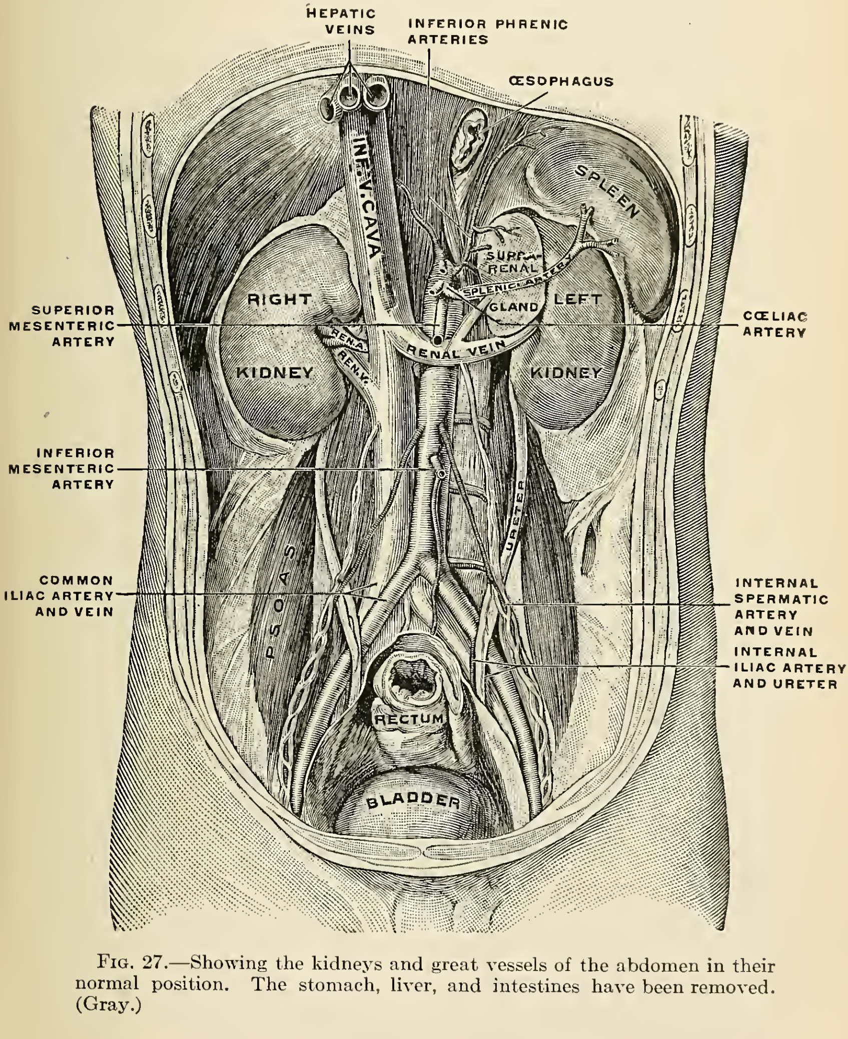


FIG. 27.—Showing the kidneys and great vessels of the abdomen in their normal position. The stomach, liver, and intestines have been removed. (Gray.)

liver is sometimes ruptured, hemorrhage from the torn tissue being very profuse.

The Kidneys.—Located in the back part of the abdominal cavity, one on each side of the spine, are two bean-shaped glandular organs, the kidneys. Each weighs about five ounces. They excrete the urine, that is, they remove the excess of water and the waste products from the blood by a process which is partly filtration and partly selected cellular secretion. The urine passes from each kidney through a narrow tube about twelve inches in length, the ureter, to the bladder.

The Bladder.—The urine passes through the two ureters into a musculomembranous sac, the bladder, which serves simply as a temporary storehouse for the urine. It will hold ordinarily a pint or more and is partially under voluntary control. When full it may be ruptured by crushing injuries or by falls, allowing the urine to escape into the abdominal cavity.

The Peritoneum.—Most of the organs of the abdomen are covered by a thin, serous membrane, the peritoneum, which is kept constantly moist by a serous secretion of peritoneal fluid. The organs are thus allowed to move upon each other without friction.

When the intestines, the bladder, or any other hollow organ is ruptured the contents escape into the general abdominal cavity and come into contact with the peritoneal covering of these organs, resulting in peritonitis.

Owing to the fact that communication with all parts of the peritoneal cavity is free, the spread of infectious material is apt to be very rapid.

The Reproductive Organs.—The organs of reproduction, in both male and female, are located partially within the pelvis and partially external to the pelvis on the lower part of the trunk. Owing to the abundant nerve supply of these organs injury is apt to result in pain and evidences of shock, out of all proportion to the apparent severity of the injury received.

CHAPTER III.

WOUNDS AND WOUND INFECTION.

CONTUSIONS.

WHEN an injury has been caused by a blow with a blunt object without laceration of the overlying skin it is called a contusion or bruise. The result is a crushing injury to the tissues, associated with hemorrhage beneath the skin, which later becomes apparent in the familiar "black-and-blue" spot. This area of hemorrhage beneath the skin is known as *ecchymosis*, or *subcutaneous hemorrhage*.

Depending upon the depth of the hemorrhage, the ecchymosis appears at a variable time after the injury, and is most pronounced where the skin and tissues are very loose. Thus, about the eye, where the bleeding is immediately beneath the skin and the tissues are very loose, a comparatively slight injury may result in a large area of discoloration, which appears within a few hours. In the arms and legs it may take the blood a long time to reach the skin; that is, the black-and-blue spot does not appear at once but only after two or three days.

Treatment.—Contusions are usually painful for several days and tender to pressure for a few days longer. The black-and-blue spot gradually becomes less distinct and disappears after about two weeks. In examining a patient a contusion is felt as a tender spot. It is the familiar bruise, which is so commonly seen, and requires little or no first-aid treatment. If you are sure that there is no fracture or deeper injury the bruise itself may usually be disregarded. If the pain is very severe, bathing in cold water or the application of cloths dipped in cold water will give relief. The absorption of the blood in the tissues may be hastened after the second day by the use of hot baths and hot compresses in place of cold. If the contusion has been very extensive, rest in bed or rest of the part by use of a sling will afford considerable relief.

If a bruise appears to be unusually painful a physician should be called to examine for fracture or other injury to the deeper parts. In accidents the injured person rarely complains of an ordinary contusion. They only become aware of the bruise after several hours when they notice stiffness and pain. If, after an injury, a patient applies for treatment immediately, the surgeon suspects an injury to the deeper parts; but if he does not complain of pain until the next day, and then the disability is very slight, there is probably only a contusion and little possibility of serious injury.

Contusions of the head, chest, or abdomen have a special significance, and will be referred to later.

WOUNDS.

A wound is a separation of the soft parts of the body, associated with incision or laceration of the skin or mucous membrane. They are divided into four general types:

1. *Contused wounds*, made with blunt instruments; there is a contusion associated with a wound of the skin, usually bursting or tearing in character.

2. *Incised wounds*, those made with a knife or other sharp-cutting instrument.

3. *Lacerated wounds*, torn or jagged wounds made with rough, irregularly shaped instruments.

4. *Punctured wounds*, made by sharp-pointed instruments.

The characteristics of all wounds are pain, tenderness, and hemorrhage. The type of wound is at once apparent on inspection.

Treatment.—Wounds are the most common injuries that the first-aid worker is required to treat, and the importance of proper emergency treatment cannot be too strongly emphasized. It is here that first aid accomplishes its greatest work. Every single injury of the skin and tissues which causes bleeding externally, from the smallest pin-prick or abrasion (a superficial wound of the skin) to the terrible lacerations of the extremities, is a wound; and each and every one should receive the most painstaking care.

Cases are not rare where lack of care following an insignificant injury, such as an abrasion or a small punctured wound, has resulted in blood-poisoning and death; and there have been many cases in which intelligent emergency treatment has not only prevented fatal hemorrhage but has kept the wound clean and sterile, so that secondary infection did not occur.

There are three specific requirements for the successful treatment of wounds:

1. The arrest of hemorrhage.
2. The prevention of infection.
3. The restoration of function.

For the first-aid worker the arrest of hemorrhage and the prevention of infection are the most important. The restoration of function is largely in the hands of the surgeon.

HEMORRHAGE.

Hemorrhage means bleeding. The term is not confined to serious and prolonged bleeding, but it is applied to bleeding of every sort. It may be due to the division of a number of capillaries, when it is usually mild, or to the division of larger vessels, either arteries or veins, in which case it is more difficult to control.

Capillary Hemorrhage.—Capillary hemorrhage is the slow oozing which comes from the exposed surface of a wound. If this surface is swabbed free of blood there can be found no special bleeding-point, but the entire surface seems to exude blood. The total amount may be considerable but never enough to endanger the life of the patient. Hemorrhage which is purely capillary in character stops after a few minutes. When it is desired to stop it sooner a pad of sterile gauze is pressed against the bleeding surface and held in place for a minute or two, or bound in place with a bandage. Hemorrhage of this type may be almost disregarded because it is stopped by the application of the dressing.

Venous Hemorrhage.—This form of hemorrhage is apt to be very profuse. If a large vein is cut a patient may bleed to death, but, as a rule, the thin wall of the vein collapses and the hemorrhage ceases automatically. The blood from a vein is darker than that from an artery, and it flows slowly and steadily. Both ends of the divided vessels bleed freely, but the distal[1] end is apt to bleed more than the proximal. Direct pressure applied to the bleeding-point will stop venous hemorrhage.

Arterial Hemorrhage.—When an artery is cut the bright red blood spurts in jets from the wound. This is characteristic of arterial hemorrhage but in some cases the end of the vessel may be deep in the wound so that the spurting is not evident. As in venous hemorrhage, both ends of the divided vessel bleed freely but in this case the hemorrhage is most marked from the end nearest the heart. Bleeding from small arteries will stop after slight pressure. Only in the larger arteries is a special method required to control the hemorrhage.

METHODS OF CONTROLLING HEMORRHAGE.

Remembering that a little blood makes a great show, the first step is to determine how severe the bleeding is. In some cases the face and hand may be entirely covered with blood when the bleeding itself has entirely stopped. Locate definitely the bleeding-point before attempting to stop the hemorrhage. I have seen a patient at death's door as a result of hemorrhage from a ruptured varicose vein, simply because no one had the intelligence to look for the bleeding-point. In this case the foot was almost covered with blood and the first-aid enthusiast had carefully wrapped a sheet about the foot without noticing that the blood came from a point higher up the leg. In addition to the sheet wrapped about the foot, a tourniquet had been applied about the thigh in such a manner that the venous return from the leg

[1] The distal end is the end farthest away from the heart. The proximal end is the end nearest the heart.

was stopped but the arterial flow was not interfered with. When this patient was seen all that was required was to remove the tourniquet and make the patient lie down with the leg slightly elevated. The bleeding then stopped spontaneously.

The direct methods of controlling hemorrhage are:

1. Direct pressure.
2. Elevation.
3. Application of heat or cold.
4. The tourniquet.
5. Styptics.

1. **Direct Pressure.**—This is the most important method. In any case where pressure may be applied directly to the bleeding-point, hemorrhage will stop as long as the pressure is continued. In operating the surgeon often divides fairly large vessels. When this occurs the operator quickly puts his finger on the bleeding-point, thus immediately stopping the hemorrhage. The vessel is then clamped with a specially devised clamp, or ligated at once. Even in the arteries the pressure of the blood is comparatively slight, so that if the finger can be placed over the bleeding-point the hemorrhage can be stopped at once. However, in ordinary cases pressure with the finger is unnecessary. When most wounds are examined the hemorrhage is found to be slight or at most only moderate. If the blood is flowing in a steady stream, it requires prompt attention; if it is dropping rapidly, the patient is in no danger, but measures should be taken to stop the bleeding at once; if it is dropping slowly from the wound, say five or six drops a minute, there is no great hurry and it is permissible to take sufficient time to secure the best available material for a dressing.

Direct pressure on any bleeding wound can be secured by the use of a gauze compress, or, if one is not at hand a folded handkerchief can be used, care being taken to use sterile compresses when they are available.

A compress is placed directly in the wound and held firmly with the fingers. This will show at once whether the bleeding is under control. If not, another compress should be applied and this repeated until the wound is firmly packed with gauze. I have rarely seen an emergency hemorrhage which could not be stopped by this method.

After the compresses are in place a snug bandage is applied directly over the wound. Where the bleeding is profuse, a bandage may be placed on very tightly and left on for a few hours and then replaced by a looser bandage. Care should be taken not to leave the tight bandage on too long, for this may result in constriction of the part with secondary gangrene.

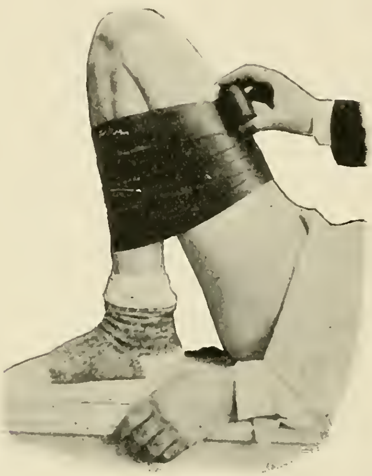


FIG. 28.—Flexion of the knee to control hemorrhage from the foot. The knee is held in acute flexion by a rubber bandage. This method is applicable only to the elbow or the knee in hemorrhage from the hand or foot. (Park.)

Surgeons apply direct pressure by the use of artery clamps and ligatures. The artery clamp is a specially designed instrument which is clamped over the end of the bleeding vessel, holding it tightly closed. A ligature is a piece of catgut string or a silk thread which is tied about the end of the bleeding vessel, just as a string might be tied about a rubber tube. Both the ligature and artery clamp are available only for advanced students in first aid and are usually unnecessary in emergency work.

2. **Elevation.**—This is a valuable adjunct to any method. If a bandaged hand continues to bleed it will often stop when the hand is held over the head. When there is bleeding from the foot, the patient is told to lie down and the foot is raised well above the body. In bleeding from the nose the head is kept erect, not bent forward over a basin.

3. **Heat and Cold.**—Water as hot as it can be borne, or ice-water, will tend to stop hemorrhage. Before the present technic was perfected surgeons sometimes cauterized wounds with a hot iron to stop hemorrhage. Both heat and cold are seldom used except where a bandage cannot be applied, as in the nose or mouth. In such cases they may be very valuable.

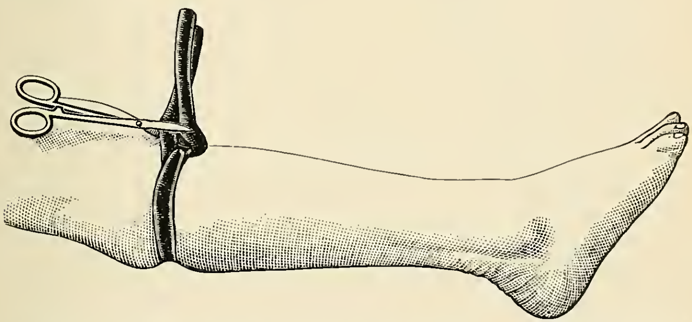


Fig. 29.—Piece of rubber tubing used as a tourniquet. The attached clamp holds the knot firm. The tubing would be more effective if applied above the knee.

4. **The Tourniquet.**—This is the most widely known and most abused instrument of first aid. It is widely known because it is easily understood and appeals to the popular fancy. It is abused because it is almost always wrongly applied. It is only applicable to hemorrhage from the extremities and to be correctly applied it must be fastened tightly enough to stop the arterial flow. If applied less firmly, it only acts to increase the hemorrhage. I have seen many cases where a tourniquet has been applied in an emergency case and I have never seen a single case where it accomplished its purpose. In most cases where I have seen

it applied all that was required to stop the bleeding was the removal of the tourniquet.

The ordinary directions for its use are as follows: A handkerchief or strip of strong cloth is placed loosely about the limb between the wound and the heart and the ends tied together. A cloth pad or hard object is placed over the location of the main artery and a stick, passed under the band at the opposite side of the limb, is used to twist the bandage so as to make the wad press firmly against the artery. If the location of the artery cannot be remembered the tourniquet is applied without the pad against the artery.

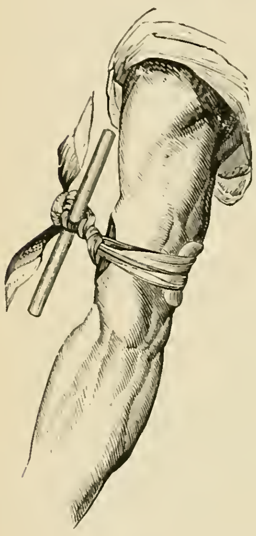


Fig. 30.—Tourniquet for control of bleeding from the arm. The pad is placed directly over the artery.

From the above description it is apparent that to correctly apply a tourniquet a certain knowledge of anatomy is necessary. As it must be applied tightly enough to compress the artery it is only possible to use it in the upper arm and thigh. In the forearm and leg, the two bones give sufficient protection to the arteries so that they cannot be compressed by the ordinary tourniquet.

For a wound of the hand or arm where other methods fail to control the bleeding the tourniquet should be applied with the pad on the inner side of the arm over the brachial artery. For a wound of the leg, where direct pressure with bandaging and elevation are not sufficient, the tourniquet is applied with a pad about one inch below the midpoint of the crease in the groin over the femoral artery.

In addition to its other disadvantages the tourniquet is apt to lead to gangrene if left on too long. After half an hour it should be removed and left off if possible.

Do not be in too much of a hurry to use the tourniquet; use it only as a method of last resort.

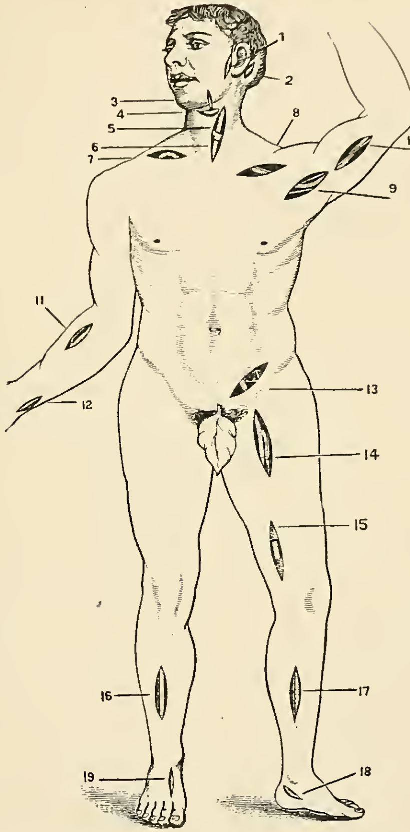


Fig. 31.—Location of the principal arteries. *1*, temporal artery; *2*, occipital artery; *3*, facial artery; *4*, lingual artery; *5* and *6*, common carotid artery; *7*, subclavian artery; *8* and *9*, axillary artery; *10*, brachial artery; *11*, radial artery; *12*, ulnar artery; *13*, external iliac artery; *14*, femoral artery in Scarpa's triangle; *15*, femoral artery in Hunter's canal; *16*, anterior tibial artery; *17*, posterior tibial artery; *18*, posterior tibial artery behind the internal malleolus; *19*, dorsalis pedis artery. Pressure to stop hemorrhage from the leg should be made at *14* or *15*; from the arm at *9* or *10*. Pressure at the other points is apt to be unsatisfactory.

5. **Styptics.**—Chemicals used to stop hemorrhage are called styptics. Hydrogen peroxide, adrenalin, tincture of ferric chloride, alum and silver nitrate have all been used. They are rarely of service except in small hemorrhages about the nose and mouth.

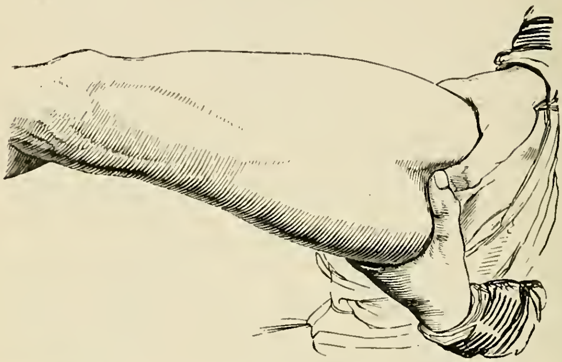


Fig. 32.—Pressure with the thumbs on the femoral artery to stop hemorrhage from the thigh or leg. (Wharton.)

INFECTION AND SUPPURATION.

When living pathogenic[1] bacteria are introduced into a wound, it is said to be infected. These bacteria may or may not cause inflammation with the formation of pus. If few in number they may be killed by the antiseptic forces of the body or by antiseptics used in the treatment of the wound. If they grow and develop the wound becomes inflamed, and there is a discharge of pus. This is called suppuration. Ordinarily, we do not speak of a wound as infected unless the wound shows suppuration.

Bacteria.—Bacteria, or germs, are microscopic organisms, so small that many millions might be lodged upon the head of a pin. There are hundreds of different varieties, only a comparatively few of which cause disease. They grow very rapidly, a single bacterium increasing to many millions in a few days.

[1] Pathogenic bacteria are those which give rise to disease in the human body.

Bacteria are found almost everywhere; in the air we breathe, in the water we drink, on the surface of the skin, and on the outside of all the objects we handle. Any object which is exposed to the air soon becomes covered with many thousands of bacteria. Even things which appear very clean and well polished give lodgment to many bacteria, while things which appear dirty and dusty are usually literally swarming with germs. Fortunately only a few are pathogenic, or disease breeding. These pathogenic bacteria are most common where many people are congregated. Thus, in theaters, schools and generally about populous centers there are many disease bacteria, while in the forests, on uninhabited sea islands and in the cold regions of the north they are very rare.

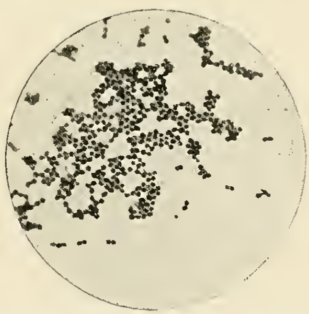


Fig. 33.—Microscopic appearance of staphylococci. Magnified 1100 diameters. (Park and Williams.)

In the European War the battles were fought in the fields of northern France. The highly cultivated earth was simply loaded with bacteria, many of which were of the pathogenic variety. The result was that almost every wound became infected. In the Boer War the fighting was largely confined to the virgin territory in South Africa containing very few pathogenic bacteria. Consequently infected wounds were less common in the Boer War.

Bacteria are divided into two main groups; the bacilli, or rod-shaped bacteria; and the cocci, or round bacteria. The cocci are further divided into: (1) Streptococci, which grow in strings or chains; (2) staphylococci, which grow in bunches; (3) diplococci, which grow in pairs. There are other general forms but the above are the varieties most frequently seen.

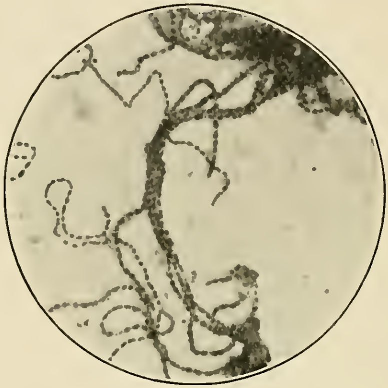


Fig. 34.—Showing how streptococci grow in chains. Magnified 1000 diameters. (Herzog.)

Many of the so-called infectious diseases are caused by bacilli, for example: tuberculosis, typhoid fever, and diph-

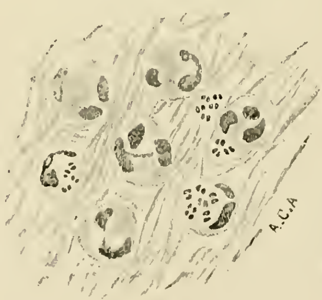


Fig. 35.—Showing diplococci being taken up and destroyed by phagocytes. (Abbott.)

theria. Suppuration and wound infection are usually caused by streptococci or staphylococci, although they may be caused by bacilli or diplococci. Pneumonia and meningitis are caused by diplococci.

Each variety of bacteria is again divided into different subdivisions. Thus we have tubercle bacilli, the bacillus of typhoid fever, the diphtheria bacillus, the tetanus bacillus, the streptococcus of erysipelas, the pneumococcus, and the meningococcus.

Some of these bacteria are specific, that is, they always cause the same disease. The tubercle bacillus, when it causes disease, always causes tuberculosis, and the tetanus bacillus always causes tetanus. Abscess formation and wound infection is usually caused by one of the various forms of cocci, rarely by the bacilli. In general, infection with streptococci is apt to be more severe than staphylococci infection.

Asepsis and Antisepsis.—When a wound or object is free from living bacteria it is said to be aseptic or sterile. Septic is the opposite term and indicates the presence of infection. Objects may be rendered aseptic by heat or by chemicals (disinfectants) strong enough to kill all living organisms.

When a thing is aseptic it is said to be "surgically clean," which is somewhat different from clean in the ordinary sense. Thus you may take a rusty needle or soiled handkerchief and boil it for twenty minutes and it will be rendered surgically clean, although apparently little changed, while the white handkerchief and the highly polished needle that has been lying on the table for several days, although apparently clean, may be covered with germs.

An antiseptic is a substance which tends to prevent infection without injuring the tissues. Thus, alcohol can be poured on the hands, killing many of the germs without causing serious injury to the hands.

In surgery, articles are rendered aseptic or sterile by one of three methods:

1. The application of heat.
2. The use of disinfectants.
3. The use of antiseptics.

Asepsis by Heat.—Heat may be applied by the open flame, by boiling, or by superheated steam. The open flame is rarely used in surgery, but it is of some use in first-aid work. A needle or knife-blade held in a flame until it is too hot to touch is completely sterilized, or aseptic. This process soon destroys the steel and is consequently seldom used.

In surgical practice, boiling is the method commonly used to disinfect instruments. Instruments, rubber goods, and glassware may be boiled without injury. In emergencies gauze and cotton may be sterilized by boiling. The boiling should be continued for at least five minutes, or, better still, twenty to thirty minutes. In hospitals and surgical supply houses, gauze, cotton, and bandages are sterilized by the use of superheated steam. This has the advantage of leaving the material dry so that it is easily handled. Small packages of sterilized material may be wrapped in muslin or in paper coverings for transportation. These coverings when dry are not penetrated by bacteria.

Disinfectants.—Strong acids and alkalies, carbolic acid (phenol), solution of formalin, and many other substances in strong solutions kill all bacteria, serving to sterilize effectually all articles which are introduced therein.

Instruments, glassware and rubber goods may be sterilized by this method; but, owing to the fact that disinfectants are injurious to the tissues, the excess must be washed off with sterile water before use. For this reason the disinfectants have a limited use in surgical practice. Their use is largely confined to the disinfection of infectious excreta and for the disinfection of waste materials, such as pus-soaked gauze, blood-stained cotton and the like.

Antiseptics.—These are substances which may be used in milder solutions to prevent the growth and destroy bacteria, without injury to the body tissues. As may be supposed they are less effective than disinfectants but they are susceptible to broad usage and in many places where disinfectants cannot be used. The most frequently used antiseptics are tincture of iodin (one-half strength), alcohol (one-half to full strength), boric acid (saturated solution), hydrogen peroxide, weak solution of carbolic acid, bichloride of mercury (1 to 1000) and many others. These solutions are of considerable value in surgery because of their convenience and because they are not very injurious to the tissues. Some antiseptics, such as tincture of iodin, may be used freely in some parts of the body, but are not suitable for application on the more delicate parts, as for example, about the eye. Instruments and glassware may be soaked for several hours in carbolic acid solution (5 per cent.) and rendered completely sterile.

If the skin is painted with tincture of iodin, an incision may be made and if care is taken not to allow infection to enter the wound subsequently it will heal without suppuration. In the same manner, if the skin is cut and immediately painted with tincture of iodin and covered with a dressing infection will not take place. If the same treatment is given with alcohol or peroxide of hydrogen, the antiseptic action is also obtained, but less powerfully than with tincture of iodin.

Surgical Preparation of the Hands.—Due to the fact that bacteria are always present on the surface and in the pores of the skin, it is an impossibility to render the hands surgically clean. For this reason, surgeons when operating use rubber gloves which may be sterilized by boiling or by long immersion in antiseptics.

If the hands are well scrubbed with soap and water for five minutes or longer and tests are made, very few bacteria will be found. If in addition they are immersed from three to five minutes in an antiseptic (bichloride of mercury, 1 to 1000) tests will show almost no bacteria. They are almost "surgically clean" and should be so prepared before doing a surgical operation or dressing a wound. It is important to remember that many more germs are removed by the use of soap and water than by disinfectants alone. So that in an emergency treatment it is far better to wash the hands well than to dip them in antiseptic solutions.

THE REPAIR OF WOUNDS.

The healing of wounds and the necessary measures to produce the normal return of function are more in the province of the surgeon than in that of the first-aid worker, but the emergency treatment is better understood if the first-aid worker has a clear conception of the process of healing.

When the wound heals without infection or suppuration, it is said to heal by first intention. The surgeon brings the cut ends of the tendons and skin into apposition by sutures or other suitable methods, and the small crevice between the incised surfaces fills with blood clots which remain aseptic. Within a few days small bloodvessels grow through these thin clots and enter the opposite surface of the wound.

FIG. 36.—Swelling and inflammation of the forearm and hand from an infected wound of the hand. (Ashhurst.)

In time proliferation of the cellular elements holds the wound edges firmly together, and healing is complete. There is little or no discharge from such a wound.

When there is suppuration or when the edges of the wound are not approximated, the wound heals by granulation. In such cases the wound fills from the bottom and the edges, which become covered with a soft bright red cellular tissue called granulation tissue. The slow proliferation of this tissue gradually fills the wound until it reaches the level of the skin. The skin slowly grows inward from the margin of the denuded area, finally covering the surface of the wound.

Primary union, or healing by first intention, usually takes place in about a week and the union is firm at the end of the second week. Compared with this, healing by granulation is very slow. Even a comparatively small wound may require several weeks, and large wounds may not be entirely healed after four or five months.

Fig. 37.—Infection of the finger from a neglected wound. This should have been incised several days before. (Park.)

Clinical Course of Infected Wounds.—When a wound is infected there is a period varying from a few hours to a few days during which it is to all appearances aseptic. This is the incubation period during which the bacteria, though present and active, do not make themselves evident.

Following this is the stage of reaction when the wound becomes painful and tender. The edges are reddened and indurated (hard). The presence of bacteria causes a congestion in the region of the wound. The white cells are thrown out as a protective agency to destroy the bacteria, and in certain stages of the process the white cells may be seen, microscopically, in the process of devouring the bacteria. The mixture of serum, bacteria, white blood cells, and partially destroyed tissue cells is called pus.

If the pus can be freely discharged, and the bacteria are not powerful enough to overcome the body resistance, healing will take place. But if the discharge is confined so that it cannot escape or if the bacteria are especially poisonous, the area increases in size, and cellulitis, or blood poisoning, may result. This is shown by pain, redness, and swelling of the part. (Figs. 36 and 37.)

In cases in which the discharge is free and the infection is subsiding, healing takes place from the bottom and the wound gradually fills with granulation tissue while the suppuration still continues. After a week or ten days the suppuration has usually to a large extent subsided and healing by granulation proceeds in a normal manner.

SUMMARY OF THE TREATMENT OF WOUNDS.

A. Clean Wounds.

1. *Inspection of the wound* to determine the degree of injury and the amount of bleeding.

2. *The cleansing of the hands* with soap and water.

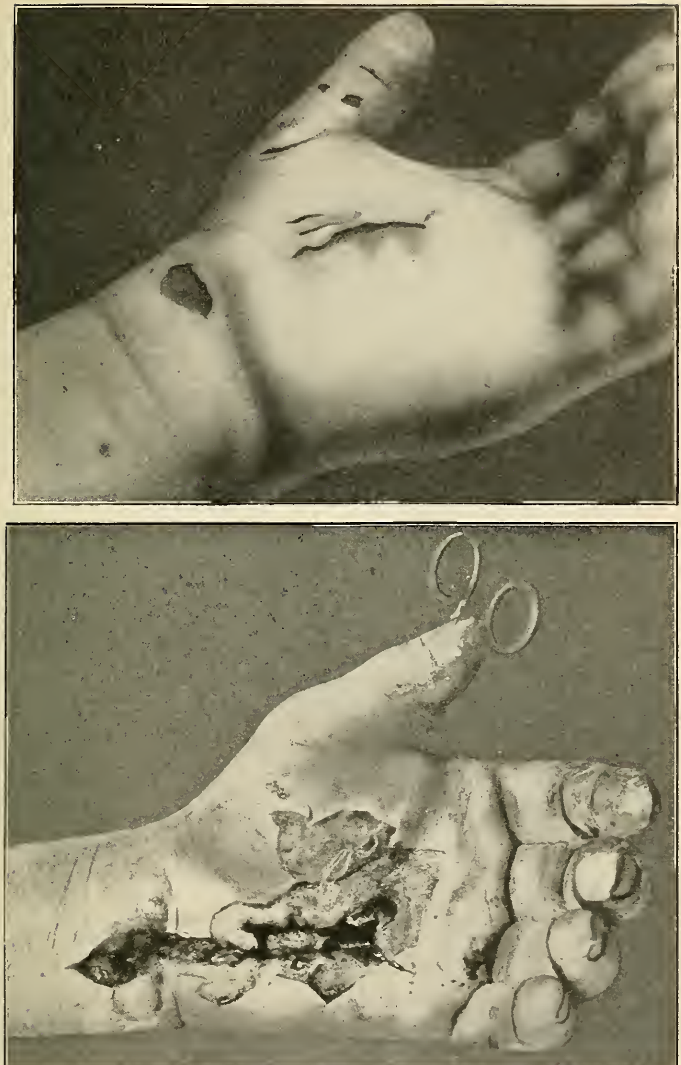
If there is time, before handling the wound, the hands should be rendered surgically clean by the method previously described.

3. *The sterilization of the wound.*

(*a*) If the wound is apparently clean it should be painted with tincture of iodin (one-half strength) or rinsed with alcohol (50 per cent.). The iodin should be swabbed on the cut surface as well as upon the surrounding skin.

(*b*) Wounds showing gross contamination with dirt and grime. These wounds are best treated by preliminary washing with soap and water followed by thorough rinsing with clean water. Iodin or alcohol may then be applied.

4. *The Dressing.*—Sterile gauze is placed over the wound so as to stop the bleeding. If sterile gauze is not obtainable, a clean handkerchief or piece of linen may be soaked in 50



FIGS. 38 and 39.—Showing the appearance of a badly infected hand before treatment and the same hand after it had been incised by the surgeon. (Kanavel.)

per cent. alcohol, whisky, or other antiseptic solution and applied wet to the wound.

5. *Bandaging.*—A bandage is applied to hold the dressing in place. If hemorrhage is profuse, several compresses and a very firm bandage may be necessary. A tourniquet is rarely required and should never be applied until other measures fail.[1]

Fig. 40.—Felon of the thumb which has opened spontaneously. Incision would have prevented this large area of ulceration. (Park.)

B. **Infected Wounds.**—When a wound shows evidence of infection (increased pain of a throbbing character, swelling and redness) it requires treatment at once. If professional advice is not available, the treatment should always be directed toward securing free discharge. The dressing should be removed at once.

This, in itself, often allows the discharge which has been retained by the adherent dressing to escape. A continuous

[1] Owing to the excessive bleeding it may be necessary to apply a dressing without the preliminary care of the hands and the wound. It may be necessary to pack the wound quickly with the available material at hand. If this is so, secure the cleanest material possible. A clean handkerchief or towel is a substitute for sterile gauze under these circumstances, care being taken to unfold the towel or handkerchief so that an absolutely clean spot is brought next the bleeding surface. After such a dressing has been applied the wound requires expert care as soon as possible.

wet dressing is then applied, using preferably a saturated solution of boric acid to keep the dressing constantly wet. If boric acid is not available, 10 per cent. alcohol or witch-hazel may be used. The essential point is to keep the dressing wet so that drainage may be free, and this may be done

Fig. 41.—Inflammation about the finger-nail as the result of an infected "hang-nail." (Kanavel.)

with ordinary tap water if no antiseptics are at hand. Carbolic acid is *never* used as a wet dressing, because it may cause gangrene.

Clean wounds if not deep or extensive may not require the services of a physician; infected wounds always need professional care. Whenever pus is present beneath the skin, or elsewhere in the body, an incision is required at the earliest opportunity. Figs. 37 and 38 represent an advanced stage of suppuration which should have been treated by incision before becoming so pronounced.

CHAPTER IV.

BANDAGING.

A BANDAGE is a strip of cloth, usually muslin or gauze, which is applied to the body to hold a dressing in place, to secure splints, or to protect and support any part of the body. In physicians' offices and in hospitals the roller bandage is used almost exclusively, but, in emergency work, the triangular bandage is often more easily secured and applied. If neither form is obtainable a handkerchief or torn strips of clean cotton or linen cloth may be used. As the bandage material does not come in contact with the wound it is not necessary that it be sterilized. However, a sterile bandage is an additional precaution against infection, and most of the bandages prepared by the surgical supply houses are sold in sterile packages ready for use.

THE TRIANGULAR BANDAGE.

This bandage, often called Esmarch's triangular bandage, is made from any suitable material, preferably unbleached muslin, by cutting a piece about a yard square diagonally from corner to corner, forming two triangular bandages. The result is a triangular piece of cloth with one long margin, the base, and two shorter margins, the sides. The corner opposite the lower border, or base, is called the apex or point of the bandage. The two other corners are termed the ends. The bandage may be made from any suitable material, and may vary in size, but for satisfactory work the base should be at least 40 inches in length.

To fold the bandage, when not in use, the two ends are brought together, thus folding it perpendicularly down the center,[1] then the ends and point are folded over to the base

[1] When folded in this manner, the bandage forms a triangle, half the size of the original. It may be conveniently used in this smaller size in some locations.

of the perpendicular, thus forming a square, which is again folded through the center. The rectangle thus formed is folded, forming a square, and again folded, forming a rectangular packet about six inches in length, which easily fits into the pocket.

For use, the bandage may be used open or folded, either broad or narrow. In folding for use, the bandage is spread out with the base toward you and the point is brought down to the middle of the lower border. Then fold it toward you, once for the broad bandage, two or three times for the narrow bandage. The bandage is never placed directly in contact with the wound, but only after the sterile dressing has been applied. The method of application of this bandage for the various regions of the body is as follows:[1]

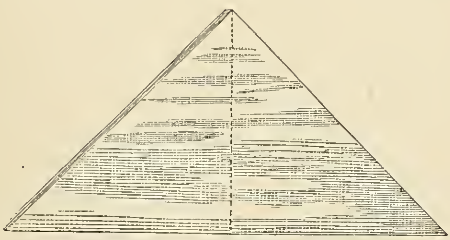


Fig. 42.—The triangular bandage. (Wharton.)

Wounds of the Scalp.—Lay the middle of the bandage on the head so that the lower side lies crosswise over the forehead, the point hanging down over the nape of the neck. Carry the two ends backward over the ears, cross them at the back of the head, bring them forward and tie them on the forehead. Then stretch the point forward, turn it over the back of the head and fasten it with a pin.

Wounds of the Forehead.—Fold the bandage narrow, lay its center over the wound, and, carrying the ends backward tie them at the opposite side of the head, or, if the bandage be long enough, the ends may be crossed at the back of the head, carried forward and tied in front.

[1] Instructions for Using the Triangular Bandage. Published by the Society for Instruction in First Aid to the Injured, New York City.

Wounds of the Chest.—Place the middle of the bandage on the chest with the point over one shoulder, carry the two ends around the chest and tie at the back; next draw the point over the shoulder downward and tie or pin it to one of the ends.

Wounds of the Hip.—Fold a bandage narrow and tie it around the body for a waist belt. Lay the center of a second bandage on the wound, with the point upward, pass the ends around the upper part of the thigh, cross and carry to the front, and knot them together. Next pass the point under the waist belt and fasten it with a pin.

Fig. 43. — Diagram illustrating various ways of applying the triangular bandage.

Wounds of the Upper Arm.—Place the center of a broad-folded bandage on the front of the limb, carry the ends around to the opposite side, cross them, bring them back, and knot them together. Next take a broad-folded bandage, throw one end over the shoulder on the wounded side, carry it round the neck so as to be visible at the opposite side; then bend the arm carefully and carry the wrist across the middle of the bandage hanging down in front of the chest. This done take the lower end over the shoulder on the sound side and tie the two ends together at the nape of the neck. This second bandage forms a sling for the arm.

Wounds of the Forearm, with Broad Sling for Arm.—Bandage the wound as above. Then take a second bandage, throw one end over the shoulder on the sound side, and carry it round the back of the neck so as to be visible at the opposite side, where it is to be held fast; place the point behind the elbow of the injured arm and draw down the end in front of the patient. Next, bend the arm carefully and place it across the chest in the middle of the cloth. Then take the lower end upward over the shoulder on the wounded side and knot to the other end at the nape of the neck. This done, draw the point forward round the elbow and fasten it with a pin.

Wounds of the Hand.—Take a bandage, spread it out, and lay the wrist on the lower border with the fingers toward the point. Next turn the point over the fingers and carry it up on the wrist. This done, carry the ends round the wrist, fixing the point, carry them back again and knot together.

Wounds of the Thigh, Knee or Leg.—Bandage in the same manner as was directed for wounds of the upper extremity. Usually a single bandage is all that is required.

Wounds of the Foot.—Take a bandage, spread it out and place the sole of the foot in its center, with the toes in the direction of the point. Draw the point upward over the toes and the instep of the foot; then take the ends forward round the ankle, across the instep, carry them downward and knot them together on the sole of the foot, or, if the bandage be long enough, cross them, bring them forward again, and knot on instep.

To Secure Splints.—Ordinary or improvised splints may be applied to the broken limb, and held in position by taking two triangular bandages, folded broad or narrow according to circumstances, and tieing them securely, one above and the other below the fracture.

To Improvise a Tourniquet.—Fold the triangular bandage narrow and tie it about the limb over a firm pad above the course of the main artery; then insert a stick under the bandage and twist it until such pressure is brought to bear upon the artery that the circulation of the blood through it is stopped.

THE FOUR-TAILED BANDAGE.

This is made from a strong piece of cloth about a yard long and five or six inches in width. The ends are split down the middle to a point three or four inches from the center. It is particularly applicable to wounds about the head and face.

Wounds of the Scalp.—The center of the bandage is placed over the dressing and the end allowed to hang down on both sides. The two front ends are then drawn back and pinned at the back of the neck and the two back ends are drawn forward and fastened beneath the chin. If the dressing is on the back of the head the ends are crossed and fastened under the chin and over the forehead.

FIG. 44.—Four-tailed bandage of the chin. (Wharton.)

Wounds of the Chin. (Applicable also to fracture of the lower jaw.)—The bandage should be narrower than that described above, about three inches in width, and the slits should be extended nearer to the center of the bandage. After the dressing has been applied (or without a dressing in the case of fracture) the center of the bandage is placed over the point of the chin and the lower tails are carried upward and fastened over the top of the head. The upper tails are then fastened back of the neck.

THE ROLLER BANDAGE.

The roller bandage is made by tearing strips of muslin or gauze about five yards long, and three or four inches in width. These are rolled either with the fingers, or by machine, into a closely wound roll. When narrower bandages are required the roll may be cut, transversely, with a sharp knife into the desired width.

To Roll a Bandage.—In rolling a bandage it is necessary to make the first turns very tight, or a loose bandage, which is very difficult to apply, will result. The roll is started by folding the end of the bandage tightly upon itself until a small firm roll is formed. This is held by the ends between the thumb and index finger of the left hand. The loose end of the bandage passes between the thumb and index finger of the right hand. The roll is grasped in the palm of the

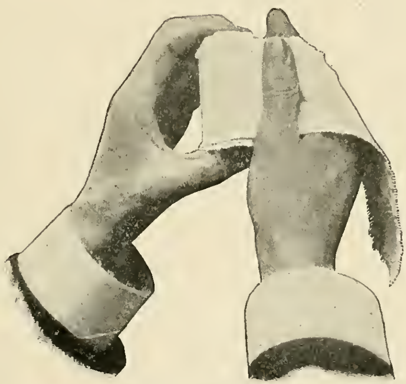


Fig. 45.—Method of rolling a bandage by hand. (Wharton.)

right hand and by a rotary movement of the right wrist combined with the alternate holding and loosening of the left hand, the roll can be completed. With a little practice a tightly wound roll may be obtained.

Machine-rolled bandages are more satisfactory for use. They may be rolled with a hand machine, or may be purchased ready for use.

Application of a Bandage.—A few inches of the bandage is unrolled and the loose end taken in the left hand while the roll is held in the right. The outer side of the bandage is then placed next to the dressing and the bandage carried around the part to be dressed, making a single turn, which anchors the bandage. The simplest form of bandage, the circular bandage, is applicable to portions of the body and

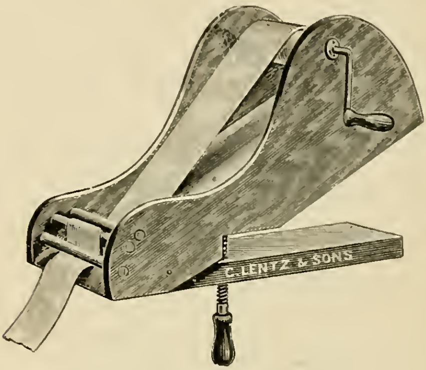


Fig. 46.—Bandage winder. (Wharton.)

extremities where the size remains the same. In this case the bandage is carried around and around the part in a spiral until the dressing is entirely covered. When this is done the end is cut and secured either by a pin or by tearing

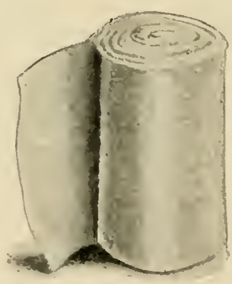


Fig. 47.—Roller bandage. (Wharton.)

the bandage into two tails, one of which is passed backward about the limb and tied to the other end on the opposite side.

Figure-of-eight Bandage.—In bandaging an arm or leg it is found that a simple circular bandage does not fit snugly. There is a fulness of one edge at some point. In order to overcome this the direction of the bandage is altered until both edges fit snugly. This means that the bandage must be turned sharply upward and carried around the limb several inches above the previous turn. It is now brought downward and forward over the upward turn, crossing it and forming a figure-of-eight. This process is repeated, overlapping each turn slightly, so as to cover in the entire part.

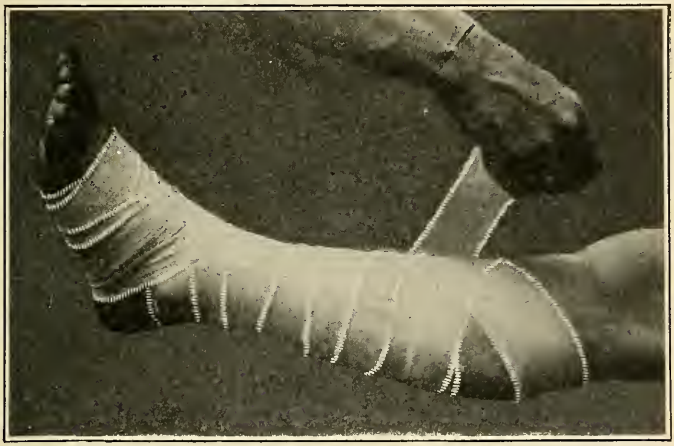


Fig. 48.—Figure-of-eight bandage of the leg. (Wharton.)

The slack or fulness is located at the back of the upper turn, where it will be covered with subsequent turns. Care should be taken in any bandage to have it applied firmly, but never tight enough to act as a hindrance to the circulation.

Spiral Reverse Bandage of the Forearm.—Another method of taking in the slack which occurs along one side of a bandage applied to a part of the body which shows variation in size and shape is the spiral reverse. On the arms and legs, which are roughly cone-shaped, the lower edge of the circular bandage is always loose, especially in stout persons. Unless the spiral reverse or the figure-of-eight is applied, the bandage will be uneven in appearance and easily disarranged.

In making a spiral reverse of the forearm the bandage is first fixed by two circular turns about the wrist. The third turn is made to run up the forearm so that both edges of the strip lie smoothly on the forearm. The right hand holds the bandage taut and the left thumb is placed upon the lower margin of the bandage at a point corresponding to the median line of the forearm. The right hand is now allowed to relax and the bandage, turned toward the operator through an angle of 180 degrees, is passed around the limb and again drawn taut. There is now a reverse of the bandage at one point, and the next turn may be made smoothly about the forearm overlapping the preceding turn about one-half. Each time the bandage reaches the front of the arm a reverse is made. Near the elbow where the forearm grows smaller the reverse may be discontinued and the bandaging continued by the use of circular turns.

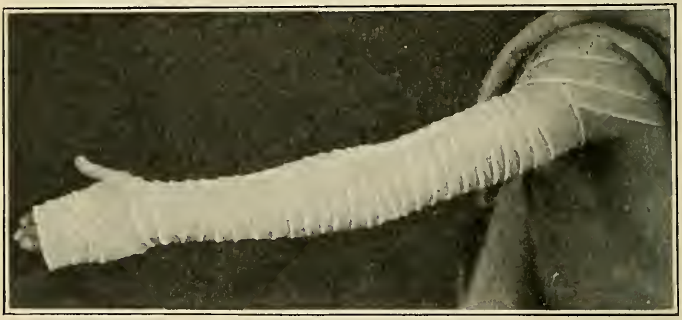


Fig. 49.—Spiral reversed bandage of the upper extremity. (Wharton.)

If this bandage is correctly applied the forearm will be smoothly covered and the reverses lie in a straight row down the front of the forearm.

The spiral reverse may be applied in the same manner to the arm, leg, or thigh.

Spica of the Shoulder.—The term spica is generally used to denote a bandage which includes a part of the extremity and a part of the trunk. The spica of the shoulder begins by two or three circular turns about the upper part of the arm on the affected side. The bandage is then carried a little upward and across the shoulder, obliquely downward across the back, under the armpit of the opposite side, and upward across the chest to the affected shoulder, and finally around the arm. The next turn follows the first, overlapping about one-half at the shoulder, but exactly coinciding beneath the opposite armpit. When completed the shoulder will be covered.

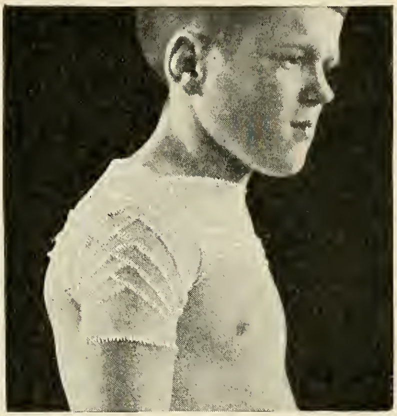


FIG. 50.—Spica of the shoulder. (Wharton.)

Spica of the Groin.—Two circular turns are taken about the upper part of the thigh and the bandage is then carried obliquely upward to the waist line, crossing the thigh from within outward. It is then carried once and a half about the waist to the front of the abdomen, from whence it is directed obliquely downward, crossing the first oblique turn on the front of the affected thigh and finally covering the first turn made around the thigh. The turns are repeated until the groin is entirely covered.

Spica of the Buttock.—The operator stands behind the patient and begins the bandage by two turns about the upper part of the thigh, the turns being made from within outward, as in the preceding bandage. For the left buttock the bandage is carried obliquely upward across the left thigh to the waist line on the left side, then around the abdomen to the right side, making a full circular turn about the waist to the back. From this point the bandage inclines downward to the left thigh, crossing the first oblique turn over the left buttock and then making a single turn around the thigh. This process is continued by overlapping the oblique turns until the buttock is entirely covered. For the right buttock the turns are the same, but run in the reverse direction.

Fig. 51.—Spica of the buttocks. (Wharton.)

The Spica of Both Groins.—This bandage is begun by a circular turn about the waist and carried on to the left thigh in an oblique direction. After a circular turn about the thigh the bandage is carried obliquely back to the waist and a circular turn made. It is next passed obliquely to the right thigh. These turns are alternated until both groins are covered. The buttocks may be covered in the same manner by making the points of crossing behind.

Figure-of-eight of the Elbow.—This should always be applied when the elbow is partially bent. Otherwise it will prove too tight and most uncomfortable. The bandage begins by a circular turn about the upper part of the forearm and is carried obliquely across the bend of the elbow to the lower part of the arm, where a complete turn is made. The next turn brings the bandage obliquely down across the bend of the elbow to the forearm, where it encircles the forearm a little higher than the previous turn. The figure-of-eight is then continued, overlapping the turns until the point of the elbow is covered.

The bandage may be applied in the reverse direction, that is, beginning at the point of the elbow. Two circular turns pass around to the elbow at this point; the third turn is now carried a little above the first two turns at the outer side and the fourth turn a little below them; all the turns coinciding at the bend of the elbow. In this manner a figure-of-eight is developed which soon covers the entire region of the elbow. The bandage is fixed by a circular turn about the forearm.

Fig. 52.—Figure-of-eight bandage of the elbow. (Wharton.)

Figure-of-eight of the Knee.—This corresponds exactly to the figure-of-eight of the elbow.

Finger-tip Bandage.—This is begun by two turns of a narrow bandage about the wrist. The third turn is brought down obliquely across the back of the hand to the affected finger, where it is passed once or twice around the finger to fix it firmly in place. It is turned on itself at a right angle and held by the finger of the left hand while the right hand draws the bandage downward over the tip of the finger to the front of this finger. The direction is changed, the fold being held by the thumb of the left hand and the

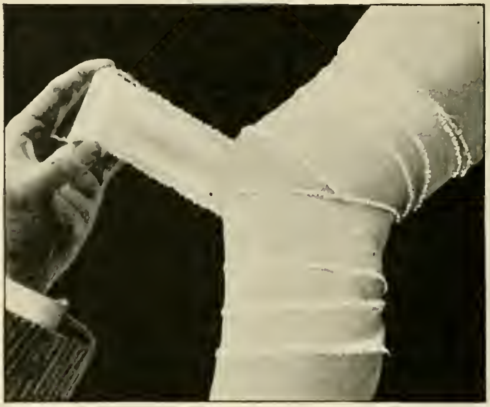


FIG. 53.—Figure-of-eight bandage of the knee. (Wharton.)

FIG. 54.—Spiral bandage of the finger. (Wharton.)

bandage brought back to the back of the finger where it is held with the left forefinger. This is repeated until there are several turns over the tip of the finger. Holding these folds in place, the direction of the bandage is again changed and a circular turn made about the end of the finger over the loose folds which cover the tip. The bandage is then carried up the finger, either by circular turns or by a spiral reverse, to the base of the finger, from whence it is carried across the back of the hand to the wrist, where it is fixed. If more than one finger requires bandaging, the same bandage may be used by passing obliquely to the second finger after completing the first bandage at the wrist.

Fig. 55.—Gauntlet bandage. (Wharton.)

Fig. 56.—Demigauntlet bandage. (Wharton.)

Gauntlet Bandage.—This is similar to the preceding except that the tips of the fingers are not necessarily covered. The bandage passes from the wrist to the finger and spirally around the finger to the tip. No attempt is made with these first turns to cover the entire finger. A circular turn is then made about the end of the finger and the bandage continued to the base either by a figure-of-eight or a spiral reverse. From the base of the finger the bandage goes back to the wrist and then to a second finger until all the fingers are covered. It will now be found that the entire back of the hand is covered, but the palm is left free.

In the *demigauntlet* the bandage is the same, except that the fingers are not bandaged. The turn around the wrist is made and brought down to the base of the finger, a single turn being made, and the bandage then brought back to the wrist. The bandage is carried to the other fingers in the same manner, the result being that the back of the hand is covered but the palm and fingers are left free.

A *reverse gauntlet* is a similar bandage so applied as to cover the palm while the back of the hand is left free.

Fig. 57.—Bandage of the foot, not covering the heel. (Wharton.)

Figure-of-eight of Ankle and Foot.—It begins by a circular turn about the ankle and then passes obliquely downward to the base of the toes where a single turn passes around the foot. It then runs obliquely across the upper surface of the foot to the side of the foot where it parallels the sole to the back of the heel, then, running around the heel it passes forward parallel to the outer edge of the sole to about the midpart of the foot. From this point it passes obliquely over the foot, crossing the previous oblique turn. In this bandage the lower margin is made firm while the upper margin is left slack to be covered by the second turn of the figure-of-eight. As the bandage is continued the third or fourth turn falls naturally around the ankle where the bandage is fixed. This bandage does not cover the point of the heel.

Figure-of-eight of the Heel.—This bandage begins with a circular turn directly around the heel and instep. The next turn coincides with the first at the instep but overlaps slightly below the heel. This is followed by another turn which overlaps slightly above the heel, thus forming a figure-of-eight. These turns are repeated until the entire heel is covered. The bandage may be completed by circular turns about the foot or ankle, as required, or it may be continued up the leg.

Fig. 58.—Recurrent bandage. (Wharton.)

Recurrent Bandage of the Toes.—The toes are seldom bandaged separately as are the fingers. After the dressing is applied, the bandage is started on the upper surface of the foot and held in place by the fingers of the left hand. It passes directly downward over the toes and onto the sole of the foot. About two inches from the toes it is held by the left thumb and turned directly backward over the toes to the upper surface of the foot. This process is repeated until the toes are all covered and the ends of the recurrent strips are held in place by a few circular turns about the foot.

Recurrent Bandage of the Stump.—An amputation stump may require bandaging. This is accomplished in exactly the same manner as the recurrent bandage of the toes.

Figure-of-eight of the Leg.—A circular turn is made about the ankle and the bandage carried upward by spiral turns until the increasing size of the leg causes the lower margin of the bandage to become slack. This usually occurs after about three turns. The bandage is then inclined obliquely upward to above the calf and a circular turn is made about the leg at this point. The next turn is inclined obliquely downward, crossing the upward turn obliquely, and another circular turn is made about the ankle just above the previous circular turns. The bandage is then carried upward, overlapping the upward turn and again passed around the leg just above the calf. These turns are all repeated until the leg is covered. After the first few figures-of-eight the circular turns may be omitted. If there is much tendency to swelling of the foot, this bandage should be combined with the figure-of-eight of the foot and ankle.

FIG. 59.—Recurrent bandage of an amputated stump covered with a spira reverse extending up the limb. (Wharton.)

Eye Bandage.—For the right eye. A one and a half-inch bandage is fixed by two circular turns about the head above the ears, running from right to left in front. The third turn is carried downward at the back of the head below the right ear, and then upward, covering the right eye. The left eye is bandaged in the same manner, excepting that the bandage is reversed, beginning from left to right. For both eyes the first three turns are put on as above and the fourth turn is continued around the head. When this turn reaches the front of the head the bandage is carried downward from right to left over the left eye, below the left ear and finally upward to join the circular turns. A single turn is completed bringing the bandage to the back of the head from whence it is carried downward below the right ear, over the right eye and back to the forehead. The turns continue alternately until both eyes are covered.

Fig. 60.—Bandage of the right eye. (Wharton.)

Fig. 61.—Bandage of both eyes. (Wharton.)

Ear Bandage.—The ears may be covered in exactly the same manner as the eyes except that the turns are made to overlap at the region of the ear instead of at the eye.

Head Bandage.—The back of the head may be bandaged with a two-inch bandage fixed by two circular turns around the head above the ears. The third turn covers the first turns in front, but behind, it is carried about one-half inch below the previous turns. The fourth turn again covers the previous turns in front, but is carried upward about one-half inch behind. By continuing these turns, keeping the bandage a single width in front and alternating the turns, first below and then above at the back of the head, a large area may be successfully bandaged.

If this process is reversed and the circular turns made to overlap behind, the forehead may be covered by making each turn a little higher in front than the previous turn.

The top of the head cannot be covered by either of these bandages. This portion of the scalp may be covered by a bandage which starts at the top of the head and is carried directly downward, behind the left ear, under the chin and upward in front of the right ear to the starting-point. The second turn is carried downward, covering the first turn behind the left ear, then under the chin and upward, this time behind the right ear. The third turn passes around the head in the same manner, this time in front of both ears. There are thus three distinct turns; one passes behind the

Fig. 62.—Bandage adapted to wounds of the back of the head, or of the forehead. (Wharton.)

left ear and in front of the right; the next passes behind both ears; and a third passes in front of both ears. The alternating turns in front of, and behind the ears hold the bandage firmly fixed. This bandage may also be adapted to the treatment of wounds of the face.

Recurrent Bandage of the Head.—For this bandage a two-inch roller is used. The bandage is started on the forehead and carried in the midline over the top of the head to the nape of the neck. It is turned upon itself and brought back to the starting-point, the second strip being carried slightly to one side. On reaching the starting-point the bandage is again reversed and carried backward, overlapping about one inch to the other side. When this third fold of the bandage reaches the nape of the neck it is again folded upon itself and brought back to the forehead overlapping the second fold. If this process is repeated the entire scalp will be covered with overlapping folds running backward and forward. With the last fold the bandage is turned on itself so as to make a circular fold about the head above the ears, which holds the end of the recurrent folds firmly in place.

As will be noticed the bandage over the scalp is very loose and incapable of exerting the slightest pressure.

Fig. 63.—Recurrent bandage of the head. (Wharton.)

Circular Bandage of the Neck.—A dressing of the neck may be held in place by a simple circular bandage. It is very important not to exert pressure in bandaging the neck. The bandage should be simply laid on. Any attempt to draw the bandage taut will result in constriction of the neck, with great discomfort to the patient.

Barton's Bandage.—This bandage is of especial use in fracture of the lower jaw, but it may be used to hold a dressing in place in any region covered by it.

A two-inch bandage is started at the top of the head and carried downward behind the left ear, around the back of the neck and forward along the right side of the jaw to the chin. Curving in front of the chin the bandage runs along the left side of the jaw below the left ear, to the back of the neck, and from here is carried upward behind the right ear to the starting-point. From this point the bandage continues in the same direction over the top of the head and downward just behind the left eye to the chin, which it passes directly under, and is carried upward across the right cheek, behind the right eye to the starting-point. This completes the bandage, but the turns may be repeated several times for security.

FIG. 64.—Barton's bandage for fracture of the jaw. (Wharton.)

Bandage of the Neck and Axilla.—A dressing of the axilla or armpit may be held in place by a figure-of-eight bandage of the neck and axilla. The bandage is fixed by two circular turns around the upper part of the arm, the third passing upward behind the shoulder to the front of the neck, around the neck, in front of the shoulder, under the armpit, behind the shoulder, and again to the front of the neck; thus forming a figure-of-eight. This figure-of-eight turn may be repeated, and if desired, circular turns about the neck or arm may be added.

Bandage of the Chest and Axilla.—This bandage is adapted to hold a dressing in one axilla.

The bandage starts in the midline and is carried over the shoulder and around beneath the injured armpit, across in front of the chest, under the armpit of the opposite side and across the back to the shoulder of the injured side. From here the bandage passes downward under the axilla, across the back to the opposite axilla and around to the front of the chest at the starting-point.

Figure-of-eight Bandage of the Chest.—This bandage starts over the breast-bone and passes to the right shoulder, curving behind it to the axilla and forward on the chest to the starting-point. From here it passes obliquely across the chest in the same direction to the left shoulder, around

Fig. 65.—Anterior figure-of-eight bandage of the chest. (Wharton.)

which it passes to the left axilla, running forward and across the chest to the starting-point. This completes the anterior figure-of-eight of the chest. The posterior figure-of-eight of the chest is made in a similar manner, starting from the midline of the back.

Breast Bandage.—This may be made to retain dressings or to make pressure on one or both breasts. To bandage the right breast the roller is started beneath the breast and carried horizontally across the chest from right to left, entirely around the chest to the starting-point. It then passes obliquely upward over the lower margin of the right breast to the left shoulder, passing over it and then downward across the back and around the chest one inch above the first horizontal turn. When this is completed a second oblique turn is made about an inch above the first. These

FIG. 66.—Bandage to support right breast. (Wharton.)

FIG. 67.—Bandage of both breasts. (Wharton.)

turns are continued alternately until the breast is entirely covered.

If it is desirable to cover both breasts the first two turns are made as above. The third turn passes around the chest to the back, from whence it passes upward to the right shoulder and obliquely downward across the chest below the lower margin of the left breast, passing around to the back to overlap the circular turns.

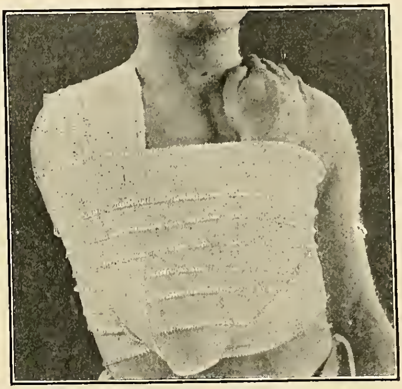


Fig. 68.—Velpeau bandage. (Wharton.)

These three turns are alternated: first the circular turn, then the oblique turn to the right breast, passing from below upward, followed by another circular turn, and finally an oblique turn passing from above downward, supporting the left breast. In the double bandage the best support is given to the breast on the side where the oblique bandage passes from below upward. In the above case the bandage applied to the right breast gives the best support. If the left breast requires a greater support, this bandage should be reversed.

Circular Bandage of the Chest and Abdomen.—In the male the breasts may be bandaged by a circular spiral running either upward or downward. The abdomen may be bandaged in the same manner.

The Velpeau Bandage.—This bandage is used to fix the arm and forearm against the chest. The forearm of the extremity to be bandaged is placed obliquely across the chest with the fingers near the opposite collar-bone. For the right arm the bandage is fixed by a circular turn about the chest, passing from right to left. It is then carried across the back to the injured shoulder and downward, over the point of the shoulder, across the outer side of the upper arm, turning on itself to be carried across the front of the chest just above the first circular turn, passing entirely around the chest. When the elbow is reached this turn passes in front of the elbow, holding it firmly against the chest and passing to the left side of the chest; from this point the bandage passes obliquely upward across the back to the left shoulder and is continued as described above, each turn overlapping the preceding until the arm is covered. This bandage is especially applicable to fractures of the collar-bone.

CHAPTER V.

FRACTURES AND DISLOCATIONS.

When an injury results in a wound of the skin it is usually fairly easy to determine the nature of the injury from inspection of the injured part. But when the body is injured by a blow with a blunt instrument, or by a fall, it is much more difficult for the first-aid worker to determine the extent of the injury to the deeper parts. There may be a sprain or dislocation, a bone may be broken, one of the vital organs may be torn or ruptured, or there may be only a simple bruise or contusion of the tissues.

Some idea of the extent of the injury may be gained from the appearance of the patient. After a severe injury there is usually considerable shock, the face is pale, the pulse is weak, and there is evidence of great pain. The converse of this is not always true. Very rarely we see patients who are suffering from fractures or other severe injuries, who have apparently very little pain. In the excitement of an accident a patient with a severe injury may temporarily forget his own pain and be of aid in helping others. On the other hand, some persons are so constituted that even the sight of blood causes a nervous shock which makes them turn pale and grow weak and faint. As a result they may appear to be severely injured.

In practice give every case the benefit of the doubt and treat as severely injured every patient who shows evidence of shock until you are reasonably certain that no serious injury is present.

FRACTURES.

When a bone is broken it is said to be fractured and the break is called a fracture. It is commonly believed that a fractured bone is different from a broken bone. This is an error; they are one and the same thing.

Bones may be broken just as a stick of wood is broken, directly across, the two ends being separated; they may be split longitudinally or obliquely; or a chip or larger piece may be broken from the end or side of the bone without permanently interfering with the function or usefulness of the bone.

In young bones there is considerable elasticity, so that they bend a little before breaking; but in the aged the bones are brittle, breaking very easily. I have seen a child fall two stories without receivng a fracture, and I have treated a man of eighty who fractured his thigh-bone by stepping down off the curb. In some cases the force of the blow will drive one fractured end of the bone directly into the other frag-

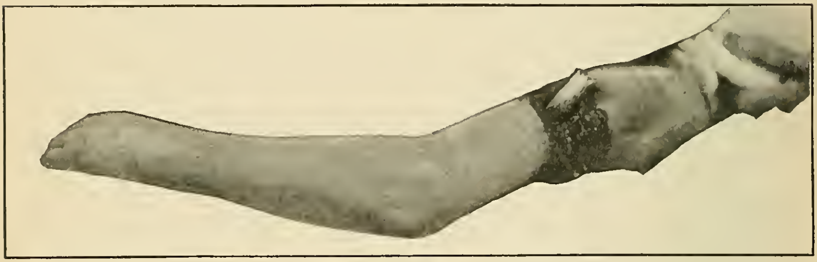


Fig. 69.—Compound fracture of the arm. Note the end of the lower fragment protruding from the wound. (Ashhurst.)

ment. This is called an impacted fracture, which, when the impaction is firm, may allow the patient a reasonably satisfactory use of the injured arm or leg.

If you will cut a branch from a tree and bend it you will notice that the branch will bend a long way and finally break on one side without separating entirely. A similar fracture of the bones occurs in children and is known as "green-stick" fracture.

In general, fractures are of two kinds, *simple* and *compound*.

If the bone is fractured without an associated wound of the skin, the fracture is said to be simple. A compound fracture is one in which the injury is complicated by a wound of the overlying soft parts.

It is very important to understand the difference between these two classes of fractures. Compound fracture is exposed to infection through the wound, and has, therefore, more serious and dangerous consequences. In compound fracture the wound may result from an external force, such as a blow or a bullet wound; or the jagged end of the bone may be forced through the skin from within. When bacteria causes infection of a wound connected with a broken bone, the bone itself is apt to become infected and the result is much more serious than that following infection of an ordinary wound.

Fig. 70. — Injury to bone inflicted by steel-mantled ball at 1300 yards. (Park.)

In gunshot fractures the fractures are always compound. In some cases the bullet causes a shattering of the bone in many pieces (Fig. 70). A fracture of this type, whether the result of a bullet wound or other injury, is termed a comminuted fracture.

Symptoms of Fracture.—The examiner recognizes the presence of fracture by symptoms and physical signs. They are:

1. Pain and tenderness.
2. Disability.
3. Deformity.
4. False point of motion.
5. Crepitus.
6. Special surgical signs.

Pain and Tenderness.—These are the most important of all the signs, and are sometimes the only signs present. When, after an injury, the patient suffers severe pain, especially when any attempt is made to move him, a fracture should always be suspected. If the pain is excruciating in character, causing the patient to cry out on any attempt at motion, there is almost certainly a fracture present.

Tenderness, or pain on pressure, is a constant symptom. In examining for a fracture it is customary to apply firm

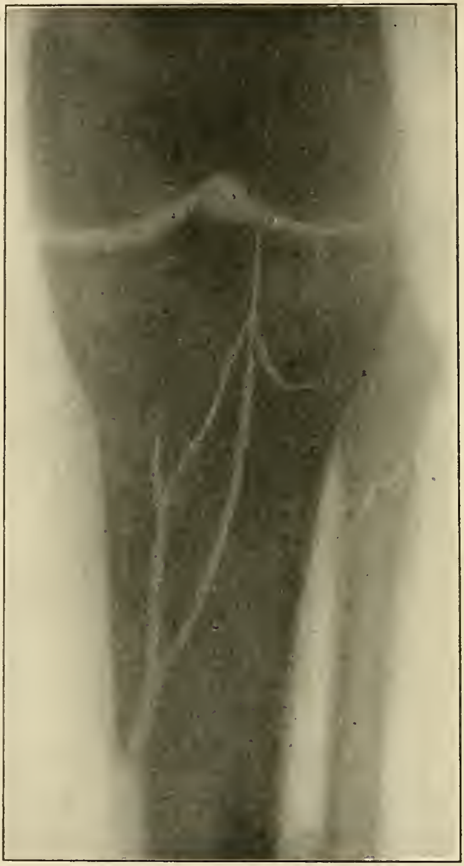


Fig. 71.—Longitudinal splitting fracture of the tibia, and oblique fracture of the fibula. This fracture would be very difficult to diagnose. (Ashhurst.)

pressure over the bone to determine where tenderness exists. When the tender spot is found a special examination is made at this point. If firm pressure does not elicit tenderness at any point there is, almost certainly, no fracture present.

The exception to the above is seen during loss of consciousness, when the detection of fracture rests chiefly on false point of motion, deformity, and crepitus.

Disability.—Partial disability is the rule in fracture. Usually the disability is immediate and marked, increasing during the first twenty-four hours.

In impacted and green-stick fractures, as well as in incomplete and chipping fractures, the disability may be very slight. A chauffeur drove his car for several days while suffering from a fractured wrist, and a child was recently seen who played about the house for over a week with only slight evidence of disability from green-stick fractures of both bones of the forearm. In a recent drama the plot rested upon the fact that it was impossible for a man who had just broken his wrist to hand a card to another man with the injured hand. To the surgeon who has seen many fractures, this statement is as absurd as the common belief that because the fingers can be moved there cannot possibly be a fracture. Remember that the disability depends largely on the severity of the fracture. Severe fractures with complete separation of the bones cause the most disability.

I believe that the inability to walk is an important sign in fracture of the lower extremity. While the foot and leg may sometimes be moved freely without pain, the patient is rarely able to bear his weight on the fractured leg.

Deformity.—The shape of the limb is altered, partially due to the swelling and partly to the break in the bone. When the bone is near the skin the broken ends may be felt. In other cases, the shortening and the crooked appearance of the limb must be depended upon in order to make a diagnosis.

False Point of Motion.—This is an important sign when present. If the limb moves at a point where there is ordinarily no joint, the bone must be broken. There is no other alternative.

Crepitus.—If you rub the two ends of the broken bone together there results a dull grating sensation which is transmitted to the examining hands and can sometimes even be heard. This is called crepitus and is an almost certain sign of fracture.

It is not wise for the first-aid worker to elicit either false point of motion or crepitus as he may thereby increase the displacement of the fractured ends. These symptoms should, however, be borne in mind, as they are frequently noted in

Fig. 72.—Ecchymosis twenty-four hours after fracture of the upper end of of the humerus. Note that there is almost no visible deformity. (Ashhurst.)

the routine examination of those severely injured. They are both absent in impacted fractures and are seldom obtained in fractures without displacement.

Ecchymosis, or hemorrhage beneath the skin, is a common symptom of fracture. It becomes evident after a day or two and appears externally as the common "black-and-blue" spot. Because it appears so late it is of little value in the early diagnosis of fractures. It also occurs after simple bruises of the soft tissues.

Special Surgical Signs.—In addition to the above signs the surgeon determines the variety and extent of the fracture

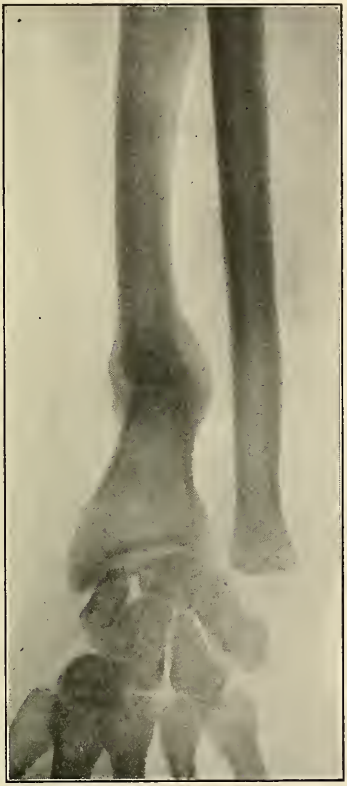


Fig. 73. — X-ray showing callus several weeks after fracture of the radius. After a few months the lump in the region of the fracture will have entirely disappeared. (Ashhurst.)

Fig. 74.—Fracture of the femur with healing in a deformed position. Vicious union. (Park.)

by other methods, chiefly the measurement of the affected parts and the use of the x-rays. The latter method is not available for emergency work but, because it gives us a picture of the fractured bone, it will be used in the discussion of certain fractures.

Union of Fractures.—Healing takes place by the growth, about the thickened ends of the bone, of a tough, fibrous material called callus. This begins within a few days, and at the end of a week or ten days results in a fairly firm union. It gradually changes to true bone, so that after two or three months the bone is as firm at the point of the fracture as elsewhere. An *x*-ray taken several months after a fracture may show absolutely no evidences of the injury.

Treatment of Fracture.—When the broken ends are displaced the process of putting them together is called reduction. Splints are used to hold the fractured ends in place (fixation). The special forms of treatment will be indicated under the different forms of fracture.

First Examine the Patient.—To determine if a fracture is present let the patient lie down in as comfortable a position as possible and examine the limb through the clothing for pain or deformity. If a fracture is suspected, remove enough clothing by cutting or ripping to examine the injured part. Move the limb as little as possible, thus avoiding pain and the danger of increasing the extent of the injury. When the limb is exposed examine it slowly and carefully in order to determine the extent of the fracture. There is no necessity for hurry in such a case. If the limb shows only slight deformity it should be supported on a soft cushion and protected until the arrival of the physician. Cold compresses, that is, cloths wet in cold water and applied to the injured part—will relieve the pain. If there is a marked deformity the attempt may be made to correct it by grasping the limb below the fracture and pulling it in a straight line. If a moderately strong pull does not reduce the deformity the attempt should be abandoned.

While it is desirable to secure the aid of a physician to reduce the fracture, there is not the same urgency as in the case of wounds. The fracture may be "set," or reduced, even after several days have elapsed. There is no harm in allowing the patient to wait several hours, or longer, if the fractured bone can be kept at rest. For those cases which must be moved before seeing a physician, a splint of some sort must be applied.

Splints are made of thin strips of wood or card-board which may be bandaged to the limb so as to prevent the separation of the fractured bones. The splint should be cut long enough to include the joint above and below the fracture, and should be a little wider than the thickness of the limb. In emergencies any form of a straight stick, such as a cane, an umbrella, or a branch cut from a tree, will serve as a temporary splint. Paste-board, folded newspapers, sole leather, and strips of tin have been successfully used. Ordi-

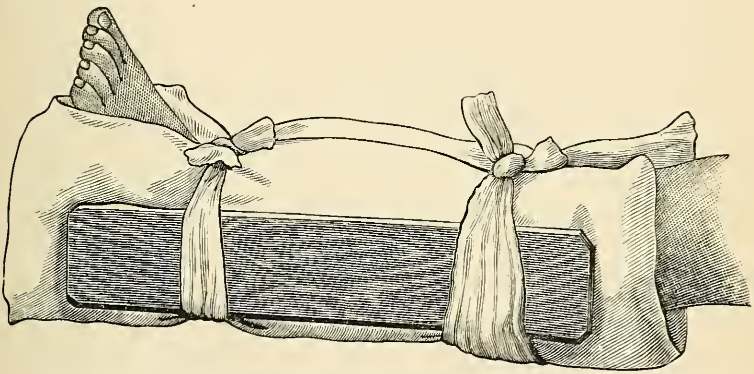


Fig. 75.—Improvised pillow splint for fracture of the leg. (Brewer.)

narily a most satisfactory splint may be cut from the thin wood used in making egg cases, or other similar boxes used in the grocery trade.

Every splint must be padded. This serves two purposes: It makes the splint fit the irregularities of the limb, consequently making it more comfortable for the patient, and the padding allows for the swelling almost certain to follow, which, if prevented by tight bandages, might cause added injury to the limb. Cotton is the best material to use for padding, but if this is not available, other material may be used, such as a folded blanket, strips of cloth, grass, hay, or any other elastic material.

In order to apply the splints the limb is held by an assistant and the splints placed one on each side of the injured limb, each splint well protected by padding on its inner side. The splint is fixed in place either with a bandage, with strips of cloth, or with adhesive plaster. They should be applied firmly enough to hold the bone in position, but the bandages should never be tight enough to cause constriction. If the splints are a little wider than the thickness of the limb the danger of constriction is minimized.

A bandage should never be applied before the splint is in place. The reason for this is that when swelling occurs the bandage will be much too tight.

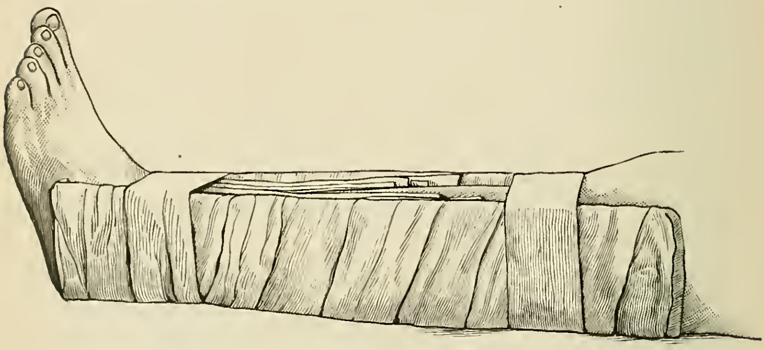


Fig. 76.—Side splints for fracture of the leg. (Brewer.)

In some cases, such as fracture of the skull and fractured ribs, it is impossible to apply a splint; and in others, such as fracture of the arm near the shoulder, it is simpler to bandage the arm firmly against the side of the body than to use a splint.

After the splint is applied the patient should wait for the surgeon with the limb held in the most comfortable position, or he may be taken to a nearby hospital or physician's office. If a long trip must be taken before reaching professional aid, it is better to allow the patient to recover from the shock of the injury before the trip is made. A few hours, or even a day's delay is not of serious consequence.

The patient should be moved in the position of greatest comfort. If the wrist is fractured and the distance short the patient may be allowed to walk with the wrist supported by the other hand or in a sling. If the ankle or foot is fractured the patient may ride in a sitting position with the foot resting on a cushion. When the thigh is fractured the recumbent position is the most comfortable.

Special Fractures.—Fracture of the Skull.—This may be caused by a blow or fall. Any portion of the skull may be fractured. It may be associated with symptoms of concussion or compression.[1] Bleeding from the mouth, nose or ears is seen in fracture of the base of the skull. Pain is sometimes the only symptom.

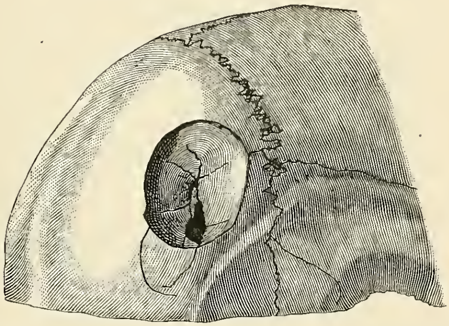


FIG. 77.—Showing circumscribed depressed fracture of the skull. (Stimson.)

The patient should be put to bed if a fractured skull is suspected, even if he feels perfectly well. The head should be slightly elevated and an ice-cap or cold compress applied. When a wound is present it should be dressed and a bandage applied. Because of the danger of injury to the brain, a physician should be summoned at once in all suspected fractures of the skull.

Fracture of the Spine.—This is a very serious fracture. It may be suspected when, after an injury to the back or neck, the patient cannot move the legs. There are usually severe

[1] Concussion and compression are fully described under Regional Injuries.

shock, associated with shooting pains on any attempt at movement.

Movement may increase the deformity and cause irreparable damage to the delicate spinal cord, so that it is better to allow the patient to lie quietly until the surgeon arrives. Meantime a blanket may be secured and mild stimulation may be given, such as hot coffee, or a few drops of aromatic spirits of ammonia.

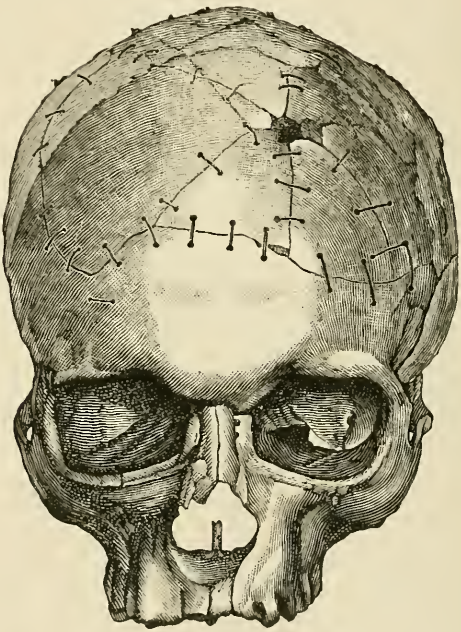


Fig. 78.—Reconstructed skull showing the many fractures resulting from a gunshot wound. (Park.)

If it is absolutely necessary to remove the patient, it should be done as carefully as possible. A stretcher should be secured and the patient placed on it, great care being taken not to bend the spine, the patient being kept flat on a stretcher or cot and not allowed to attempt to sit up while being moved.

Fracture of the spine, if it injures the spinal cord, usually causes paralysis of the lower limbs, which may never disappear. Sudden death may occur during transportation.

Fracture of the Nose.—As a result of the injury the bridge of the nose is apt to be pushed to one side. As a rule, nothing is done until the surgeon arrives. Cold compresses may be applied and measures taken to stop the bleeding from the nose if it is profuse. If it is not possible to secure professional aid for several days, firm pressure may be made in the

Fig. 79.—Fracture of the nose, eighteen hours after injury. (Ashhurst.)

direction opposite to the deformity, slightly overcorrecting it. Unless there is a wound a dressing is not required. The treatment for bleeding from the nose will be discussed elsewhere.

Fracture of the Jaw.—Usually the result of blows or falls. Movement of the jaw is very painful and, on examination of the mouth, inequality of the teeth may be noted at the point of fracture. False point of motion and crepitus may be made out when the jaw is moved. The treatment consists in a temporary bandage to hold the teeth of the upper jaw and the lower jaw firmly together, the upper jaw thus acting as a splint. The Barton bandage and the four-tailed bandage, both of which are suitable, have already been described. If considerable time must elapse before a physician is seen, an antiseptic mouth wash such as peroxide of hydrogen or weak solution of carbolic (1 per cent.) should be used to prevent infection. Any of the commercial mouth washes may be used for the same purpose. Hemorrhage is rarely troublesome. If persistent the patient should be given small pieces of ice to suck.

Fig. 80.—Application of the four-tailed bandage as a temporary dressing for fracture of the jaw. (Stimson.)

The diet should consist entirely of milk and other fluid nutrients, taken through a tube without removing the bandage.

Fracture of the Dental Margin of the Jaw.—Often a blow in the mouth results in the loss of one or more teeth, with or without breaking off the adjoining portion of the jaw. When first seen the teeth are often directed inward, attached only by a small strip of mucous membrane. In such cases the teeth and detached bone should be forced back into place at once and the patient taken to a surgeon or dentist. The jaw is bandaged and a mouth wash prescribed exactly as described above for complete fracture of the jaw.

Fracture of the Collar-bone.—If the collar-bone is broken the irregularity of the bone at the point of fracture can be easily felt. The patient should be placed flat on his back on the bed or floor and allowed to remain in this position until the surgeon arrives. If he must be moved, the uppre arm should be bandaged to the side with a circular bandage including the arm and the chest, and the hand carried in a sling. The Velpeau bandage is well adapted to this injury.

Fig. 81.—Modified Velpeau bandage applied for fracture of the clavicle (Ashhurst.)

Fracture of the Ribs.—Usually the result of falls, but may follow severe coughing spells. The chief symptoms are pain, made worse by moving or deep breathing, and a short, dry cough. Tenderness at the point of pressure and pain referred to the region of the fracture when firm pressure is made on the front of the chest are common symptoms. The treatment consists in rest in bed together with the application of a firm circular bandage about the chest or a broad band of adhesive plaster may be applied a little more than half-way around the chest. The pain may be relieved by the use of an ice-cap or hot-water bag over the painful area.

Fracture of the Arm.—The arm hangs helpless at the side; the patient involuntarily supports the forearm on the injured side with the other hand. When the arm is examined there is a local point of tenderness, and, usually, a false point of motion at the location of the fracture.

Fig. 82. — Adhesive plaster strapping for fracture of the ribs. (Ashhurst.)

Fig. 83.—Fracture of the upper end of the left humerus. The arm is swollen and there is a small area of ecchymosis in front of the shoulder. Note that there is only slight deformity. (Stimson.)

Treatment.—In some cases it may be sufficient to place a pad of cotton or other suitable material between the arm and the chest and to bandage the arm against the chest. In other cases, where the fracture is associated with considerable deformity it is better to apply a pad between the arm and the chest, and a padded splint reaching from the shoulder to the elbow on the outer side of the arm. In both cases the arm is held against the chest by a circular bandage, the

Fig. 84.—X-ray showing fracture of the humerus. (Ashhurst.)

elbow being bent at a right angle and the forearm supported by a sling.

Fracture of the Elbow.—The forearm should be placed in the most comfortable position and left in this position until the surgeon arrives. Cold compresses relieve the pain. If the patient must be moved it is best to allow the arm to remain on the pillow which is supported by the other hand. In some cases it is sufficient to support the elbow and forearm in a wide sling.

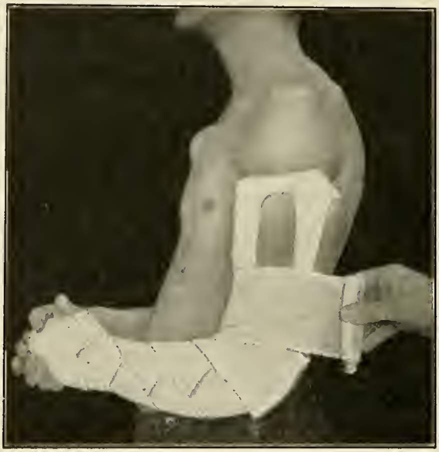


FIG. 85.—Method of applying splints for fracture of the lower part of the humerus. The bandage includes the forearm and hand in order to give additional support. The elbow is bent at a right angle. (Ashhurst.)

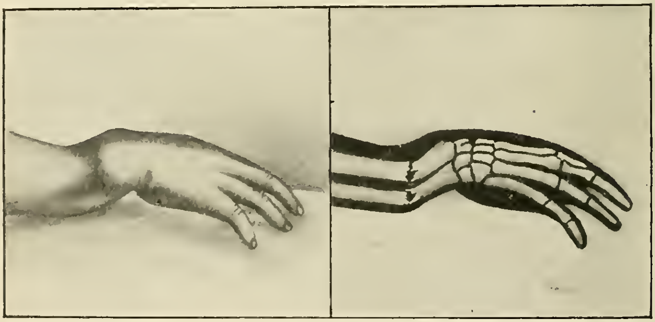


FIG. 86.—Fracture of both bones of the forearm, somewhat resembling Colles's fracture. (Park.)

Fracture of the Forearm.—In severe injuries both bones are fractured. The elbow is bent to a right angle and a padded splint placed along the back of the forearm extending from the elbow to the tips of the fingers. A similar splint is placed on the opposite side of the hand and a bandage applied. Care must be taken in the application of the bandage not to bind too tightly. Even a bandage which is loose enough at first may become too tight when the arm begins

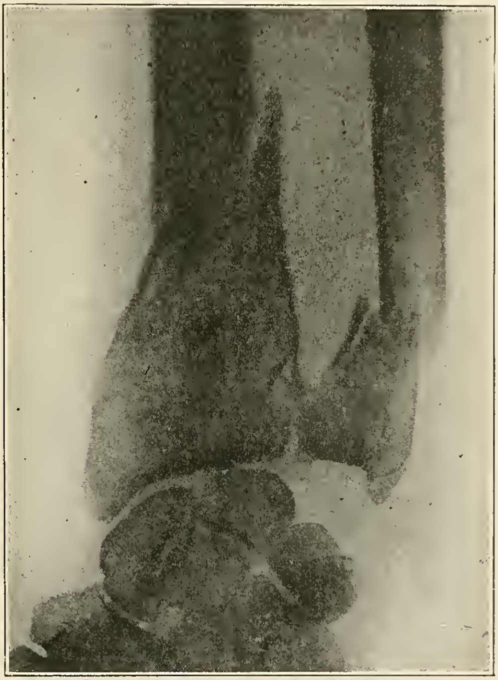


FIG. 87.—X-ray showing fracture of both bones of the forearm. (Park.)

to swell. A tight bandage is recognized by pain and numbness of the fingers, which feel cold to the examining hand. The tips of the fingers should always be left exposed so that they may be easily examined. When it is believed that the bandage is too tight it should be loosened at once. A bandage applied too tightly is worse than none.

Fracture about the Wrist.—Transverse fracture of the radius about one inch above the wrist-joint is the fracture most frequently seen in surgical practice. It is called "Colles's fracture," and results from a fall on the palm of the hand

Fig. 88.—Fracture of the wrist showing the typical silver-fork deformity. (Ashhurst.)

with the hand extended. The deformity is typical, and is called "silver-fork deformity," from its resemblance to an ordinary table fork, the fingers representing the tines of the fork.

Fig. 89.—Posterior splint for fracture of the wrist. Padding omitted for photograph. (Ashhurst.)

The emergency treatment is the same as for fracture of the forearm. In some cases a single splint (Fig. 89) is sufficient.

Fracture of the Hand.—This is usually a fracture of one of the metacarpal bones. The hand is swollen and there is severe pain on pressure over the fracture. Because the adjoining bones give support to the injured bone there is often very little disability. A padded splint should be placed along the back of the hand from about two inches above the wrist nearly to the tips of the fingers. The hand is bandaged to this support and carried in a sling.

Fracture of a Finger.—The finger may be supported by bandaging it to the adjacent finger, or a narrow splint may be applied. In the case of the thumb a splint should extend from the wrist along the back of the thumb nearly to the tip. In many cases no dressing is required, it being sufficient to protect the fingers from injury by carrying the hand in a sling.

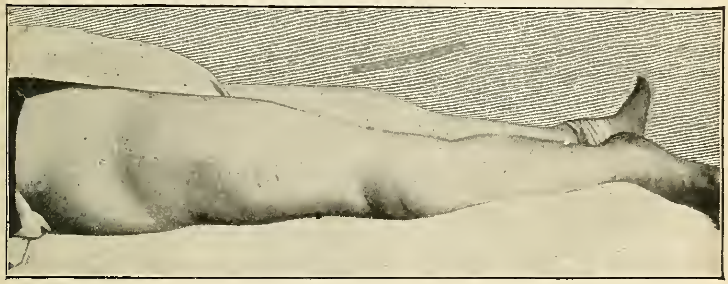


Fig. 90.—Fracture of the right femur. The patient lies helpless with the toes of the injured foot directed away from the other foot. (Stimson.)

Fracture of the Thigh.—If the patient is resting comfortably in bed no splint is required, but, if it is necessary to move him before the surgeon arrives, a long splint reaching from the armpit to the foot and about four inches in width should be bandaged to the body and to the injured leg. When the patient is transported he should be moved on a stretcher or cot. If wheel transportation is required a cot placed in a delivery wagon serves admirably.

Fracture of the Knee-cap.—The patient is unable to stand and the knee-cap is extremely tender. The knee-joint is swollen because the blood escapes directly into the joint. A long, padded splint should be applied along the back of the leg, extending from the buttocks to the heel. The patient may be allowed to sit up, provided the knee is not bent.

Fig. 91.—Fracture of the knee-cap. (Park.)

Fracture of the Leg.—Two lateral padded splints should be applied, each about three inches in width and extending from above the knee to the ankle. The same precautions

Fig. 92.—Fracture of the leg about two inches above the ankle. There is marked angular deformity. (Stimson.)

that have been outlined in the treatment of fracture of the forearm, are necessary here to prevent constriction of the leg. A pillow folded about the leg, or a blanket made into a double roll and bandaged about the leg, may be used in emergency treatment of this fracture. (See Figs. 75 and 76.)

Fracture of the Ankle.—A fracture of the lower end of the fibula with turning outward of the foot is called "Pott's

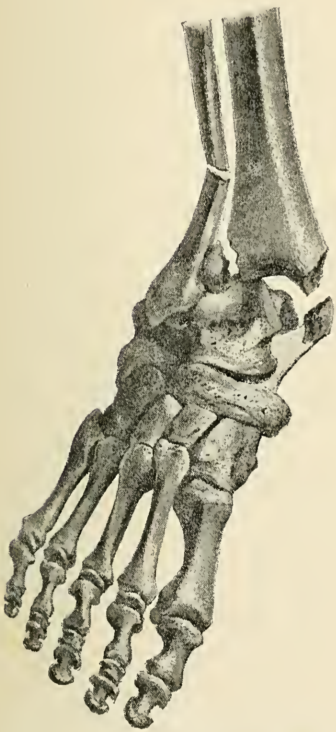


Fig. 93.—Showing the lines of fracture in Pott's fracture. (Park.)

Fig. 94.—Exaggerated deformity in Pott's fracture. (Park.)

fracture." Like a Colles's fracture of the wrist, this injury is of frequent occurrence.

If there is deformity, it is most marked externally, the foot being bent outward. In applying splints the deformity should first be overcorrected, the ankle being bent slightly inward. The foot should not be allowed to drop downward but should be fixed in position at a right angle to the leg.

Fig. 95.—Pott's fracture of ankle showing marked swelling but only slight deformity. (Stimson.)

A single lateral splint, or double lateral splints, should be applied similar to those described above in fracture of the leg,

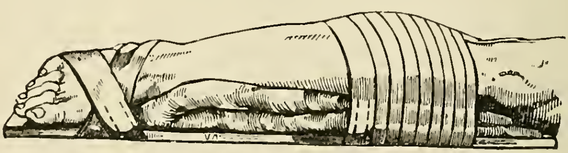


Fig. 96.—Splint applied for Pott's fracture. This not only holds the bone in place but tends to correct the deformity. (Stimson.)

except that they should begin below the knee and extend a short distance beyond the foot. The single splint, with padding along the inner side of the leg above the ankle (Fig. 96), is easy to apply and is followed by most satisfactory results. It is always placed along the *inner* side of the leg.

Fracture of the Foot and Toes.—A bandage applied over a thick layer of cotton is usually all that is required for fracture of the foot, care being taken to leave the tips of the toes exposed. If the toes become numb and cold the bandage is too tight. If fracture of the foot is suspected the patient should not be allowed to walk on the injured foot, even though he is able to walk with only slight pain.

When a toe is broken it is usually sufficient to support it by bandaging it to the adjacent toe.

Compound Fractures.—As has already been noted, a compound fracture is a fracture associated with a wound. This must be treated very carefully, because infection is very apt to occur. It is better to leave the wound untouched until sterilized material can be obtained than to apply an infected dressing.

When all material is at hand the best treatment is as follows:

1. Wash the hands well with soap and water, followed by an antiseptic such as alcohol. Do not dry the hands unless you use a sterile towel.
2. Swab the wound out well with tincture of iodin (one-half strength), being careful to reach all the crevices of the wound.
3. Then paint the skin with tincture of iodin for several inches from the edge of the wound.
4. Apply a sterile dressing.
5. Bandage loosely, bearing in mind the dangers of constriction due to subsequent swelling.
6. Apply splints in the usual manner.

DISLOCATIONS.

A dislocation is the separation of two bones normally joined together to form a joint. It may occur as simple dislocation, one bone being merely displaced from its normal position, or as fracture dislocation, in which case there is a chipping away of one margin of the joint cavity which allows the articulating[1] bone to slip out of the cavity or as a compound dislocation, in which case there is an associated wound.

Every joint is surrounded by a tough fibrous membrane, the capsule, which forms a cuff extending from one bone to the other across the joint. At certain points the capsule is thicker and stronger, forming ligaments. When a bone is dislocated, the capsule and ligaments are torn, the dislocated bone usually slipping through this opening in the capsule.

Symptoms.—The symptoms are pain, deformity, disability, and limitation of motion of the affected joint.

Treatment.—The treatment of dislocation consists of the reduction or "setting" of the dislocation, and measures to relieve the pain and to permit healing. Reduction consists of making the dislocated head of the bone retrace the steps it took in the process of dislocation; to pass backward through the same opening in the capsule and to enter the "socket" of the joint. The pain may be relieved by rest and the application of cold compresses.

When the bone is in place and the part kept at rest the torn capsule and ligaments heal by scar tissue. This is fairly firm in ten days or two weeks, but is not as firm as normal until five or six weeks have elapsed.

Habitual Dislocation.—Habitual dislocation is the name given to those cases where the same joint is easily and frequently dislocated. If the limb is not kept at rest the dislocation is apt to recur before the torn ligaments are firmly healed, and if this is frequently repeated a permanent opening is left in the capsule through which the head of the bone easily slips. Patients who are subject to recurrent dislocations sometimes can reduce the dislocation without aid. If the joint is kept at rest for ten days or two weeks after a dislocation and excessive motion prevented for several weeks longer the condition is not apt to recur.

Persistent Dislocation.—Persistent dislocation is a dislocation which has not been reduced. If reduction is not

[1] Forming a joint. Two bones forming a joint are said to articulate and the joint itself is called an articulation.

accomplished during the first week it is apt to be very difficult or even impossible to effect it. The best time to reduce a dislocation is within a few hours after the injury, before the swelling has become pronounced. A delay of a day or two, however, is rarely serious.

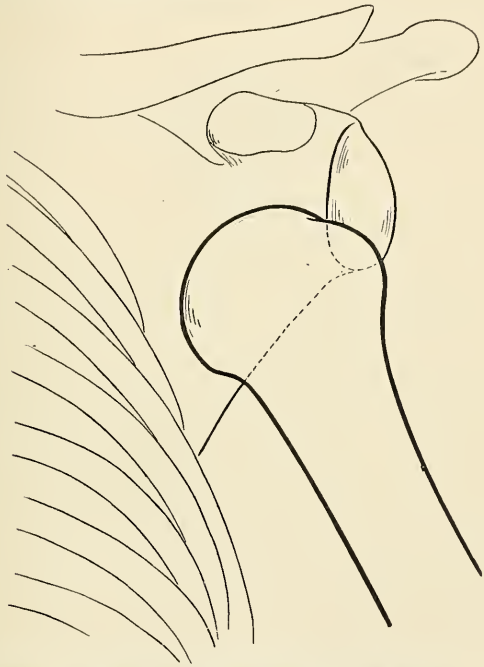


Fig. 97.—Diagram showing forward dislocation of the shoulder. Note that the head of the bone has slipped out of the socket. (Speed.)

Patients with an unreduced dislocation finally recover some use of the limb, the head of the bone forming an imperfect joint in its new location; but the degree of motion is limited, and, at the best, only a fraction of the normal movement of the joint.

Special Dislocations.—Dislocation of the Spine.—Dislocation of one vertebra upon the other may occur. It is usually associated with injury to the bones and spinal cord, and the symptoms and treatment are essentially the same as for fracture of the spine.

Dislocation of the Clavicle.—The joint at either end of the clavicle may be dislocated. It may be possible to slip the dislocated end in place by drawing the shoulders directly backward, at the same time pressing directly upon the

Fig. 98.—Anterior dislocation of the upper end of the left humerus. (Stimson.)

projecting end of the bone. A Velpeau bandage or other similar bandage may be applied with a pad over the dislocated end of the bone.

Dislocation of the Shoulder.—This is a common form of dislocation. The head of the bone usually lies in front of the joint beneath the clavicle. The motion of the shoulder is limited and the patient is unable to place the hand on the opposite shoulder.

To reduce the dislocation the patient is placed on his back on a cot or table, and an assistant standing on the opposite side holds the patient about the chest close to the armpit. The operator now grasps the injured wrist and pulls firmly and steadily at right angles to the body. After pulling for a few minutes, in order to tire the muscles, the arm is slowly brought down to the side, the steady pull being kept up in the long axis of the arm. A second assistant may make pressure on the head of the bone.

Fig. 99.—Unreduced fracture dislocation of the elbow. Side view. (Ashhurst.)

In muscular individuals it is often impossible to reduce the deformity without an anesthetic. In such cases a temporary dressing is applied by placing a large pad of cotton under the arm and bandaging the arm to the chest. The elbow is bent and the wrist supported in a sling until the services of a surgeon can be secured.

If reduction has been successful the above dressing is applied to prevent recurrence. Too much force should not be resorted to in attempts at reduction, because there is danger of fracturing the bone itself and thus adding a serious complication to the original injury.

Dislocation of the Elbow.—This is usually a fracture-dislocation. It is best treated as a fracture until professional assistance can be secured. Cold compresses relieve the pain.

Fig. 100.—Dislocation of the elbow backward. Outline drawing of bones. (Speed.)

In rare cases, where a physician cannot be secured for several days, an attempt may be made to reduce it as follows: The elbow is bent at a right angle and the arm allowed to hang by the side, the patient being in a sitting position. The wrist is grasped by one hand and held firmly while the operator makes pressure downward with the other hand at a point on the forearm adjacent to the crease at the elbow. When the muscles are relaxed, an assistant grasps the arm just above the elbow and draws it in a direction away from the hand. If this is successful the bones will come together with a click. In order to prevent recurrence the arm is bound to the chest with the elbow bent to a little less than a right angle. After the third or fourth day the arm may be removed daily from the bandage and the joint moved a little, but, except for this, it should be firmly bandaged to the chest for at least two weeks. It should be carried in a sling for two or three weeks longer.

Dislocation of the Wrist.—This is an extremely rare dislocation. Most cases which appear to be dislocations are fractures of the lower end of the radius. (See Colles's fracture.) The treatment is the same as for fracture.

Dislocation of the Fingers.—The finger should be pulled in the long direction of the fingers until the bone slips into

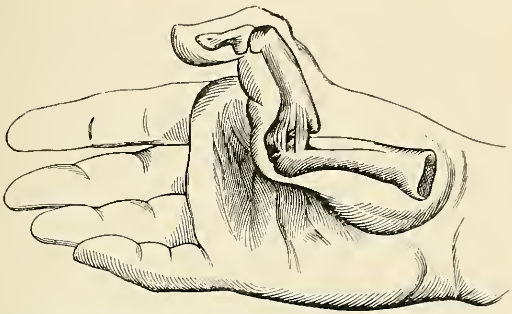


FIG. 101.—Diagrammatic sketch showing dislocation of the thumb. This can usually be reduced by pulling the thumb toward the ends of the fingers. (Park.)

place. Pressure may be made on the projecting end of the bone. A cold compress held in place by a bandage relieves the pain and gives all the support required.

Dislocation of the Jaw.—This is a not uncommon dislocation, and usually occurs when yawning or laughing. The jaw

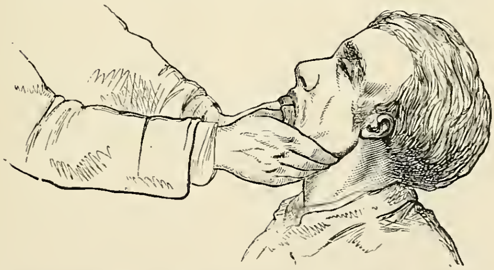


FIG. 102.—Method of reducing dislocation of the lower jaw. (Park.)

is held wide open and cannot be closed. To reduce the dislocation the patient is placed upright in a chair, and the operator, standing in front of him, places the thumbs on either side upon the lower back teeth and presses downward and then a little backward. The jaw will snap into place. In order to protect the thumbs, they should be well wrapped with a strip of gauze or a handkerchief, otherwise they may be injured when the jaws snap together.

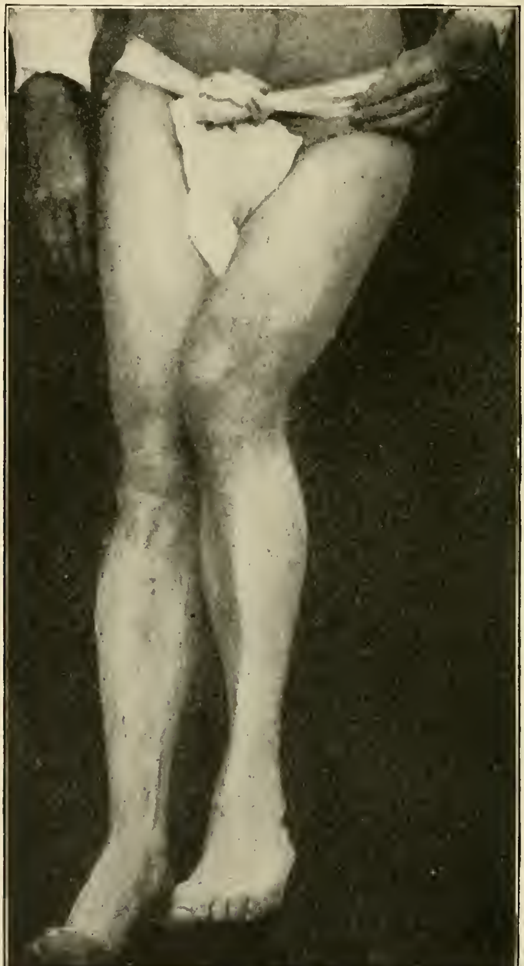


Fig. 103.—Deformity due to dislocation of the upper end of the femur backward. This is a common form of hip dislocation. (Stimson.)

Dislocation of the Hip.—The patient lies helpless and is unable to move the injured thigh. This is a very difficult dislocation to reduce. The attempt may be made as follows: With the patient lying on his back and held by an assistant, the leg is steadily and firmly pulled directly downward. It is then slowly moved outward until it forms an angle of about 60 degrees with the other leg. At this point it is slowly rotated, until the toes on the injured side are directed a little outward and finally, the pull being constantly kept up, the leg is brought back to the midline again. If this is not successful it is better to wait for the arrival of the surgeon. If the patient must be transported he should be carried on a cot or stretcher. A splint is not required.

Dislocation of the Patella.—This is a rare form of dislocation. The patella is usually dislocated outward or simply turned on edge. Direct pressure will often cause it to snap back into place. The knee should be kept stiff with a posterior splint for several weeks.

Dislocation of the Knee.—Almost always a fracture dislocation. Should be treated as a fracture.

Dislocated Meniscus.—In the knee there is a small piece of cartilage, triangular in shape, called the meniscus. This may be caught between the two bones, causing the knee to "lock." The patient has a sharp pain and falls to the ground and is unable to bend the knee.

If the patient is placed upon his back so that the muscles are relaxed and attempts made to move the knee the cartilage will usually slip out from between the bones. Following this the patient is able to walk with only slight pain but in a few hours the knee begins to swell and is very painful. For this reason the patient should be put to bed at once and cold compresses applied to the knee.

As this condition is apt to recur, patients soon learn to unlock the joint without aid.

Dislocation of the Ankle and Foot.—Any dislocation in this region is apt to be associated with fracture, and should be treated as such.

Dislocation of the Toes.—Dislocation of the toes is treated in the same manner as dislocation of the fingers.

SPRAINS.

When a joint is subjected to sufficient strain to tear the ligaments a sprain results. In dislocation the ligaments tear and the bone slips out of the socket, but in sprain the injury stops when the ligaments are torn, so that a sprain may be considered as a beginning dislocation.

Among first-aid workers a common error is to mistake a fracture for a sprain. More than half of the "sprains" which come to the surgeon for treatment prove to be fractures. Always hesitate to diagnose a case as sprain unless there is very slight disability. For example, if a patient can walk without difficulty, but has a painful and swollen ankle, the case is probably a sprain. If the injury is severe enough to prevent walking it is almost certainly a fracture.

There is an old saying that "a bad sprain is worse than a break." This is an error which arose because many injuries were diagnosed as sprains and treated as sprains when they really were fractures. As a consequence the constant irritation of the fractured bone which was not put in a splint caused more pain and disability than a fracture which was recognized and treated as such. Until you have considerable experience suspect a fracture in every case of "sprain" of even moderate severity.

Treatment.—In general, sprains may be treated by one of two methods.

The *first method* consists of rest combined with the application of cold for one or two days followed by firm bandages and massage with gradually increasing use of the joint.

The *second method* consists of massage and a firm bandage from the first, allowing the patient moderate use of the injured limb from the time of the injury. The bandage must be applied very firmly and removed daily for massage which must always be in the direction of the flow of venous blood, that is, toward the heart. Care must be taken in this method not to cause constriction of the limb by the use of a bandage which is too tight. Adhesive straps serve admirably as a support. They should be applied so as to nearly surround the limb, a narrow space being left to allow for swelling.

The method chosen depends somewhat upon the severity of the injury. The first method should be chosen if there is the slightest possibility of fracture.

In any case where pain and disability persist for more than a few days a physician should be consulted. As most sprains must be treated on general principles, only a few will be given in detail.

Fig. 104.—Sprained right ankle. Note the swelling especially on the outer side. (Ashhurst.)

Sprained Ankle.—This is the most common and typical sprain and will consequently be discussed first. Usually the ligaments on the outer side of the ankle are torn and the ankle is especially tender at this point. The usual history of a sprained ankle is that the patient "turns" the ankle. After a moment of severe pain he is able to walk with very little pain. Several hours later when the swelling becomes more extensive the pain grows very severe again. In fracture of the ankle this period of comparative comfort is usually absent.

Either method of treatment may be used. If the sprain is not too severe the ankle may be strapped or bandaged firmly and the patient allowed to walk from the first day. The bandage should be worn for about three weeks. To prevent recurrence laced shoes should be worn for several months.

Sprained Wrist.—This is rarely severe. A tight bandage or a leather wrist support keeps the wrist sufficiently at rest until healing can take place.

Sprained Fingers.—The fingers and thumb are frequently sprained. Usually a bandage for a few days is all that is required. If the pain persists, adhesive straps may be used for support.

Sprained Knee.—Sprained knee is usually caused by a twisting injury. The joint may become greatly swollen, owing to exudation of serum into the knee-joint (water on the knee). In such cases the patient should be put to bed with an ice-cap applied to the affected knee. After three days, when the swelling and pain have decreased, the knee should be well wrapped in cotton, a firm bandage applied and the patient allowed to walk about. During the subsiding stage massage and hot application will serve to aid recovery.

Sprained Back.—The term "sprained back" usually includes several different conditions. True sprain consists of injuries to the ligaments between the pelvis and the spine or between the various vertebræ, caused by sudden twisting or bending of the back. The same injury may cause a tearing or rupture of the thick muscles of the back, this latter condition being termed a strain in contradistinction to the tearing of the ligaments, which is a sprain.

A closely allied condition known as lumbago may follow exposure to cold, especially when combined with unusual muscular exertion. Clinically, these three conditions are hard to differentiate and they are consequently all treated in the same manner.

Treatment.—In severe cases the patient is confined to bed but ordinarily he merely avoids active muscular exercise. A combination of three forms of treatment is advised: Massage, support and the application of heat.

Massage tends to increase the blood supply and to carry off the extravasated blood which is always present in the tissues after a sprain or strain.

Support may be secured by a heavy bandage applied around the back and abdomen, or by a wide canvas belt. Overlapping strips of adhesive plaster, extending across the back and well onto the abdomen, is one of the most satisfactory forms of support. For the chronic cases canvas elastic belts and other mechanical supports have been devised.

The application of heat may be made with the ordinary hot-water bottle or bag, or with hot cloths or sand-bags. Usually dry heat acts best.

A satisfactory form of treatment, combining heat and massage, consists in placing the patient face downward in bed, covering the back with a piece of flannel and ironing the back with a hot iron. The movement of the iron up and down the back serves as massage.

WOUNDS OF BONES AND JOINTS.

Closely allied to fractures and dislocations are wounds of bones and joints. When bones are wounded the injury is practically a compound fracture even if only a small cut has been made in the bone. The treatment is the same as for compound fracture.

In wounds of the joints there are the same dangers of infection and blood-poisoning as in the case of compound fracture. The preliminary treatment of the wound is the same and the necessity of adequate professional care is even more urgent than it is in compound fractures.

Bullet Wounds of the Bones and Joints.—The introduction of a bullet or other foreign body into a bone or joint increases the probability of infection. While the bullet itself is apt to be sterile it carries into the wound pieces of clothing and dirt from the surface of the body so that the wound is almost certainly infected. The first-aid treatment consists in the application of tincture of iodin to the wound and surrounding skin together with the transportation of the patient to a hospital or other point where skilled surgical attention may be secured. Do not, on any account, probe the wound or attempt to remove the bullet. Such attempts only succeed in introducing more infection into the wound.

Figs. 105 and 106.—Experimental gunshot fractures with .30 and .38 calibre bullets at high velocity. (U. S. Army Med. Museum.)

During transportation the part should be kept at rest by the use of an appropriate splint.

CHAPTER VI.

MISCELLANEOUS INJURIES.

BURNS.

Burns may be caused by contact with fire or hot substances or by contact with certain chemicals. All burns are the result of destruction of tissue either by the action of heat or chemicals.

For convenience of description burns are divided into three classes or degrees.

A first-degree burn is one in which there is simple reddening of the skin, such as is seen as a result of sunburn. In this only the most superficial layer of the skin is injured and there is no blister formation. Healing is not accompanied by scar formation.

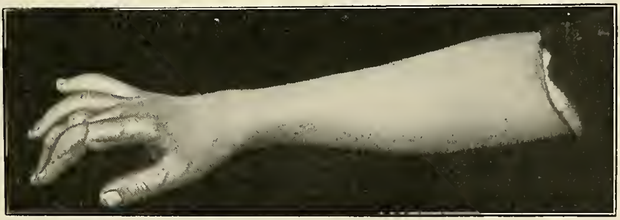


Fig. 107.—Scald of back of hand twenty-four hours after injury, showing blister formation. (Ashhurst.)

A second-degree burn is the most common type, the destruction of tissue extending deeper, with the formation of blebs or blisters. In cases which do not become infected scar formation is comparatively slight.

Third-degree burns are associated with destruction of the entire thickness of the skin, occasionally with charring of the tissues. Extensive scar formation follows healing.

As the nerve supply of the skin is very abundant, burns are extremely painful and are apt to be accompanied by considerable shock.

The severity of a burn depends upon two factors: the degree and the extent of the burn. First-degree burns, if extensive, are apt to be followed by serious results. An extensive burn caused by steam or hot water, although entirely of first or second degree may result in death.

Symptoms.—The symptoms vary with the extent of the burn. In small superficial burns pain and redness of the skin are the only symptoms. In deeper burns blister forma-

Fig. 108.—Scald of back of hand, showing blister formation. (Brewer.)

tion occurs shortly after the injury. In extensive burns and in those of the third degree there is a period of shock with weak pulse action and subnormal temperature. This lasts from a few minutes to several hours and is then followed by a period of reaction with fever. This fever may subside or it may be continued because of absorption from the burned area or from infection of the denuded surfaces.

Burns in children are apt to be more severe and are more often fatal than in adults.

First Put Out the Fire.—If the clothes are burning, wrap the patient in a rug, blanket, or other woolen wrap. If nothing of the sort is at hand, make the patient lie down and roll over on the ground and beat the fire with your coat or other similar object. If water is available it should be thrown on the burning clothing, but it is not advisable to leave the patient in order to secure water. On no account should the patient be allowed to walk or run in search of help.

Treatment.—For first-degree burns, such as sunburn or superficial burns with hot steam, an application of bland oil, such as vaselin or cold cream, will relieve the pain, and is usually all that is required.

For small second-degree burns, such as frequently occur and are commonly treated at home, the application of a bland oil, such as vaselin or olive oil, covered with a dressing of absorbent cotton, will relieve the pain and aid healing. In order to prevent subsequent infection, an ointment composed of 10 per cent. boric acid in vaselin is preferable to a non-antiseptic dressing. If the facilities are available the skin should be well cleansed with soap and water before applying the ointment. In the care of these small burns it is usually unnecessary to consult a physician.

The burn is dressed daily, the blebs not being punctured unless they are large and troublesome, in which case they may be nicked on one side with a pair of sharp scissors, previously sterilized. If infection becomes evident (increased pain and redness with the presence of pus) a physician should be consulted. A moderately severe local burn should be entirely well at the end of the second week.

Carron oil[1] was previously widely used in the treatment of burns. During recent years boric acid ointment has been given the preference because of its antiseptic qualities, but in very painful burns carron oil may be preferred because of its cool, soothing character. Other substances which may be used in an emergency are olive oil, fresh lard, cottonseed oil, or any other bland oil. Butter is not suitable because its high percentage of salt increases the pain. Wet dress-

[1] Carron oil is a mixture of equal parts of linseed oil and lime-water, well shaken to form an emulsion. It is freely applied to the injured surfaces and covered with cotton or gauze.

ings of bicarbonate of soda (ordinary baking soda) in 1 or 2 per cent. solutions[1] may be used.

In small burns which become infected, the contents of the blister taking on the characteristics of pus (becoming thick and turbid), it is best to cut the bleb entirely away and to apply a wet dressing of 2 per cent. boric acid solution.

Severe Burns.—These cases require the services of a physician as soon as possible. The patient should be put to bed at once and treatment started for the accompanying shock. Remember that in severely burned patients the temperature is apt to be subnormal and that the body heat should be preserved.

FIG. 109.—Showing method of treating a severe burn by the use of skin grafts. (Ashhurst.)

Treatment.—The clothing should be carefully cut away and removed except such portions as may be stuck to the skin, which should not be disturbed. One of the oils mentioned above should be thickly applied and covered with gauze or cotton held in place by a loose bandage.

For the pain, some form of anodyne must be given, preferably under the instructions of a physician; but if medical care is not available, morphin, $\frac{1}{8}$ grain repeated after half an hour if necessary, should be given at once. Opium, $\frac{1}{2}$ grain, or paregoric, 1 teaspoonful, may be given in the same manner. While the use of medications of this sort is very dangerous in unskilled hands it is preëminently proper in

[1] A rounded teaspoonful of bicarbonate of soda or boric acid to a pint of water makes approximately a 1 per cent. solution.

such a case to give some sort of anodyne to deaden the pain when medical advice is unobtainable.

If the pulse is rapid and weak and the patient is evidently in collapse, stimulation should be given as outlined under the treatment of shock. The careful cleansing of the burned area should be omitted until the patient has recovered from the primary shock.

Afterward the burns can be exposed, cleansed and carefully dressed. There is always absorption from the burned areas causing fever for several days or longer. During this period (which may last for weeks) the patient should be kept in bed on a full, nourishing diet, careful attention being given to general nutrition, digestion, bowels, skin, etc. Burns which become infected should be dressed with gauze kept wet with 2 per cent. boric acid solution.

The healing of extensive burns is apt to be very long drawn out, lasting for weeks or months.

Chemical Burns.—Burns may be caused by strong acids, such as sulphuric or nitric acids; by strong alkalies, such as caustic soda, potash and quicklime; or by chemical irritants, such as iodin, capsicum, mustard, etc.

The injury caused by a strong acid or a strong alkali is different from the ordinary burn. The lesion is destructive from the beginning, there being no blister formation. On the other hand, the chemical irritants cause marked blister formation with little or no tissue destruction.

Treatment.—The first step consists in the removal of the excess of the chemical present, either by wiping it away or by washing it off with water. Wipe the excess off with a handkerchief or whatever else you have at hand and then look for water.

Certain substances may be used to neutralize the caustic. Acids should be neutralized with weak alkalies. Bicarbonate of soda is usually available in an emergency, but any other weak alkali, such as milk of magnesia or lime-water, may be used. Alkalies should be neutralized by weak acid solutions, such as vinegar or lemon juice.[1]

[1] Vinegar is a dilute solution of acetic acid; lemon juice contains citric acid.

Carbolic acid is unlike other acids in that it is not neutralized by alkalies. Carbolic acid burns should be immediately washed with alcohol or solutions containing alcohol, such as whisky or brandy.

In burns due to irritants the excess of irritant should be removed. Running water will remove a certain percentage of most irritants, but in some cases the substance is more easily and quickly removed by other solutions. Mustard can be removed by the use of oil or soap and water; alcohol will remove capsicum or iodin. After the chemical has been removed as completely as possible a bland ointment is applied and the burn dressed daily in the same manner as a burn caused by heat.

INJURIES CAUSED BY COLD.

Cold may cause local injury or a general chilling of the entire body.

Exposure to Cold.—In healthy persons exposed to extremely low temperatures for long periods, and in others (especially when weakened by exhaustion or starvation) exposed to temperatures comparatively considerably higher, the entire body may be chilled, the result being depression of the vital processes which, if continued, may finally lead to insensibility and death.

In soldiers weakened by exhaustion, sickness, and insufficient food the bad effects of exposure to cold are frequently seen.

The patient is weak, depressed, and hardly able to move about, complaining of a sensation of numbness and fatigue. The pulse is weak and the temperature is subnormal. The skin of the hands and feet is bluish or purplish in color.

Treatment.—If the condition is not marked it is sufficient to get the patient to a warm place and give hot drinks, such as hot coffee, broth or hot water. If unable to reach shelter at once a fire should be built and hot drinks prepared.

Alcoholic drinks may be given in small doses when the patient is in warm quarters. Never give alcohol to such a patient until the period of exposure is over. The action of alcohol is simply to dilate the surface bloodvessels, giving an artificial sense of warmth, while at the same time allowing a further dissipation of body heat if the surrounding air is much below body temperature.

In severe cases the patient is put to bed between warm blankets, the body is rubbed with the hands or warm rough towels, and hot drinks given as directed above.

If the patient is unconscious, an enema of eight ounces of coffee solution is injected into the rectum and, if necessary, artificial respiration is begun.

Fig. 110.—Frost-bite of hands four days after injury. Notice resemblance to burns with blister formation. (Ashhurst.)

Frost-bite.—With or without the general effects of cold, the fingers, toes, ears, or even an arm or leg may be frozen, resulting in what is known as frost-bite. The part first becomes numb and blue and later, white and stiff.

In the mildest degree of frost-bite the hands and feet, after exposure to cold, become red and swollen (chilblains), and there is a sensation of burning and itching. In more severe cases, as the circulation returns, there is an exudation of serum beneath the outer layer of the skin and blisters result. In still more severe cases the circulation does not return to the fingers and toes affected, and the part remains pale and bloodless. Later gangrene results and the gangrenous area turns black.

Treatment.—For chilblains the feet should be bathed daily with applications of alternating hot and cold water. When exposed to cold, warm stockings, which are removed when indoors, should be worn. Stimulation of the skin with alcohol or spirits of camphor tends to relieve the pain and to prevent recurrence.

When actual frost-bite has occurred, the fingers, hands, or other parts affected, should be rubbed with water which is gradually warmed. The old belief that a frost-bite should

Fig. 111.—Result of frost-bite after two days and nights of exposure. (Park.)

be rubbed with snow or ice-water has been proved an error. However, it is not desirable to secure too rapid a reaction, so that it is better to start with water about room temperature. After the circulation returns the parts are loosely wrapped in cotton and a bandage applied. If blisters or gangrene occurs the lesion should be treated in exactly the same manner as a burn.

A special form of frost-bite is caused by applying an ice-cap directly to the skin. A superficial ulceration results which is called an "ice-cap burn." If care is taken never to apply an ice-cap without a towel or piece of gauze between the bag and the skin, this injury will not occur.

INJURIES CAUSED BY ELECTRICITY.

Electricity causes injury through its local action, resulting in a burn; or through its general action, resulting in prostration and unconsciousness, a condition analagous to that of surgical shock.[1]

FIG. 112.—Electric burns of right forearm and neck due to current from "live wire" carrying 1200 volts. (Park.)

It is most important that the person be removed at once from the influence of the current. A dry stick of wood or piece of rope may be used to break the contact, or the patient may be dragged away from the contact by catching

[1] The term shock, used surgically, has not the same meaning as when used in reference to electricity. However, severe electric shocks may cause surgical shock in the same manner as any other injury.

hold of a portion of his clothing. Do not hesitate because the patient is apparently lifeless. Recoveries have occurred after many minutes of apparent death.

FIG. 113.—X-ray burn, the result of too long exposure to the *x*-rays. (Park.)

After the electrical contact has been broken the patient should be examined immediately to determine the extent of the injury. If he has stopped breathing, artificial respiration should be begun at once. In this case every instant is of value, consequently the patient should not be moved from the immediate vicinity of the accident. Continue artificial respiration until the patient breathes normally or until a physician arrives. If no physician can be obtained artificial respiration should be kept up for at least an hour.

When the breathing is normal the patient should be put to bed and the general treatment for surgical shock instituted. The local burns caused by the action of electricity should be treated in the same manner as any other burn.

X-ray burns are a particular kind of electric burns. They result from exposure to the direct rays, and may follow exposure for only a few minutes. The burn does not make its appearance for several days after the exposure. Great care should be exercised by those who work about *x*-ray machines not to expose themselves to the direct rays from the light.

BITE WOUNDS.

Dog Bite.—The wound caused by the bite of a dog, cat or other animal is usually a lacerated one, and, to a large extent, the treatment is the same as for any other wound. But bites have certain general and special characteristics which differentiate them from other wounds.

In the first place they are very apt to be infected with the ordinary pus organisms. If you stop to consider the dirt and filth that is eaten by animals with their food, it is easy to understand that their mouths must contain large numbers of bacteria. In addition, hydrophobia is spread by the bite of the "mad dog," so that this disease must always be considered. While most cases of hydrophobia are caused by dog bites, the disease may be transmitted by any animal. Wounds made through the clothing are less dangerous than wounds of the hands and face, because the virus is wiped from the animal's teeth as they pass through the clothes.

Treatment.—Because any animal may be suffering from hydrophobia, and because of the possibility of infection with ordinary pus germs from any bite, every bite wound should be cauterized. Cauterization should be performed with pure carbolic acid as follows:

A swab is made by wrapping a small wad of cotton about the end of a tooth-pick or match and dipped in strong carbolic acid (phenol). The wound is then sponged dry and the carbolic acid carefully applied to every nook and cranny in the wound area. The excess carbolic acid is immediately washed away by pouring alcohol into the wound. A sterile dressing is then applied.

If carbolic acid is not available, full strength tincture of iodin may be used to swab out the wound.

Cauterization with an iron heated to a red heat has been advised, but it has recently been abandoned because of the extreme pain. It is justifiable only in cases where the animal is known to be suffering from hydrophobia.

Hydrophobia.—Hydrophobia, or rabies, is an acute infectious disease of man and animals, caused by a specific virus which must be transmitted through an abrasion or other wound of the skin.

Symptoms.—The symptoms are depression and weakness, followed by convulsions and death. The old idea that animals suffering from rabies feared water is unfounded. It arose from the fact that animals, during the convulsive stage, are unable to drink water because attempts at drinking bring on cramps of the throat. These same convulsive cramp-like seizures in man are accompanied by a gutteral sound which has given rise to the belief that men suffering from this disease "bark like dogs."

If a dog is suspected of having rabies it should never be killed until it has been shut up and kept under observation for at least a week or ten days. If the dog does not become sick and die during this time it is not suffering from hydrophobia. An animal with disease will soon begin to show symptoms. At first the animal is simply sullen, refusing food, and crawling away into dark corners. When called it either refuses to come or comes after several commands and soon shrinks out of sight. During this period the animal will drink water, but will eat little or nothing. As the disease progresses there are spasms of the throat, usually brought on by attempts to drink, and later the animal becomes excited, running about and snapping wildly at friend and foe. In this stage the animal will rarely turn out of its path to bite anyone. Still later, general convulsions and death occur.

If the animal has already been killed and you are undecided whether it was rabid or not, the entire head should be removed and sent to the health authorities for examination. The diagnosis can be made from examination of the brain.

When a man has been bitten by a mad dog there are never any symptoms for several weeks or months after the injury. This allows the patient time to wait for the laboratory report on the condition of the animal before taking the treatment.

FIG. 114.—Tooth marks made by snake bites: on the left a harmless snake; fang-marks in the center and on the right indicate a poisonous snake. (Ashhurst.)

The Pasteur Treatment.—If a human being has been bitten by a dog or other animal known to have hydrophobia, development of the disease may almost certainly be prevented by the Pasteur treatment, started within two weeks after the injury. The treatment consists of the injection of gradually increasing doses of the virus after it has been made much less powerful by prolonged exposure to the air. The important point for the first-aid worker to remember is that the patient must be sent to a competent physician for treatment not later than ten days after the injury.

Snake Bite.—Whereas hydrophobia acts through an infectious virus, snake bite acts by the direct injection of an extremely poisonous fluid. The bite of a snake is really a hypodermic injection, the poison entering the blood stream through the small punctures made by the snake's fangs.

As the poison is injected through a groove in the snake's fang, rather than simply by the saliva covering the teeth, as in rabies, the clothing gives much less protection than in the latter case.

Symptoms.—The poison acts very rapidly, the foot or hand beginning to swell at once; general symptoms develop within a few minutes. Collapse and unconsciousness may quickly result.

Treatment.—Most of the treatment must be given by the first-aid worker. There is rarely opportunity to secure a physician in time to give the preliminary treatment. In the first place an improvised tourniquet must be at once applied a few inches above the wound. This stops the circulation and prevents the rapid spread of the poison. Next, the wound should be cut widely open so that it will bleed freely and the poison sucked from the wound. This is not a dangerous procedure, for, if not swallowed, only a small amount of poison could possibly enter the system from the mouth. Then, if materials are at hand, the wound should be cauterized with pure carbolic acid or with a red hot iron and left open so that bleeding may be free.[1]

It has been shown in animals that the dose of snake venom which caused instant death could be borne if injected beneath the skin in small fractional doses, given over a period of several hours. This fact is taken advantage of in the treatment of snake bite. After the tourniquet has been in place for about half an hour it is loosened for a few minutes and then reapplied. This allows a little poison to enter the system but not enough entirely to overwhelm the body. This is repeated at intervals.

During this time the treatment of shock should be started and stimulation begun. Small doses of whisky may be given to sustain the system, but there is no advantage in intoxication, as is commonly supposed.

[1] Mason's Handbook for the Hospital Corps, U. S. Army, advises the injection of permanganate of potash in 2 per cent. solution, hypodermically, in the vicinity of the wound. This causes decomposition of the venom.

Coffee and other drinks should be given in large quantities to increase elimination, and the patient kept warm by the use of blankets and hot-water bags. As soon as the primary period of shock has passed, a dose of salts should be given as an additional aid to elimination. If the patient lives more than three or four hours, there is little danger of a fatal ending.

After recovery begins, the injury should be dressed with a wet boric acid dressing and treated as an infected wound.

Insect Bites.—Insect bites or stings result in small poisoned wounds which may be very painful. The bites of the tarantula and the centipede and the sting of the scorpion are especially painful, but are rarely dangerous to life. Surrounding the injury there is an area of swelling, and, in severe cases, there is considerable shock.

Treatment.—In mild cases weak ammonia water or solutions of bicarbonate of soda should be applied to neutralize the poison, which is acid in reaction. Following this, cold compresses, mentholated vaselin, or spirits of camphor may be applied to relieve the pain.

In severe cases the wound should be incised with a sharp knife, the poison squeezed or sucked from the wound, and the wound washed with weak ammonia or other alkaline solution. Whisky may be given and other measures taken to prevent shock. After the first symptoms have passed a wet dressing may be applied and the wound treated as any other infected wound.

Tetanus.—Tetanus or lockjaw is a general disease, the result of wound infection with the tetanus bacillus. It is especially apt to occur after punctured wounds or any other wounds where dirt is carried deeply into the tissues. The tetanus bacillus is normally found in the intestinal canal of horses, so that the disease is prone to follow wounds contaminated with dirt containing horse manure, such as stable refuse, cultivated field soil, and dirt from the streets. As the bacillus does not thrive in the open air, tetanus is more apt to follow deep, punctured wounds where the air is not in contact with the deeper parts of the wound. A rusty nail is apt to cause tetanus because the rough iron is likely to carry infected material deeply into the tissues. The symptoms do not occur until about eight days or longer after the

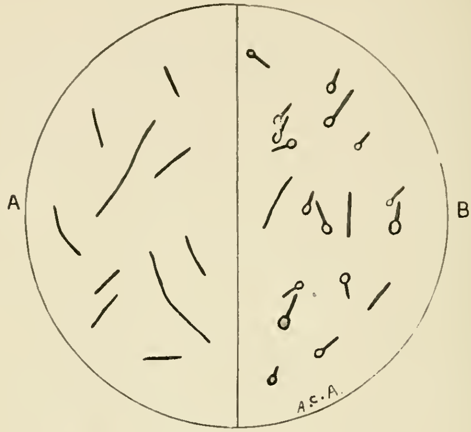


Fig. 115.—Tetanus bacilli in negative and spore stage. (Abbott.) (Magnified about 1000 diameters.)

injury. Meanwhile, the wound is apparently healing kindly with slight or no evidences of infection. The first symptoms

Fig. 116.—Convulsions in tetanus occurring on the third day of the disease. Notice the bending backward of the spine. (Ashhurst.)

noted are convulsions, beginning, as a rule, in the muscles of the jaw. The convulsions rapidly spread to other parts of the body, the patient is in severe pain, strength is rapidly lost, and death usually results after a few days. A few cases recover.

Treatment.—When a deep wound is probably contaminated with refuse from stables it should be treated as though it were known to be actually infected with tetanus bacilli.

The wound should be widely opened with a sharp knife, so that every portion of it is exposed to the air and the cavity disinfected with strong carbolic acid or tincture of iodin. It is then washed out with peroxide of hydrogen, and sterile gauze soaked in the same solution is packed into the wound. The packing is removed and reapplied daily.

In all such cases tetanus antitoxin should be secured and injected into the tissues in the region of the wound. Consequently, even if the wound itself is apparently trivial, arrangements should be made for the injection of tetanus antitoxin with the least possible delay.

Often the patient is not seen until the spasms develop. The jaws are stiff, but can be opened, and there is nervousness and apprehension. On questioning you are told that there was a small wound about a week before. Such a case should be sent at once to a hospital, where large doses of antitoxin may be given. In transporting such a patient great care should be used to prevent jars which may initiate the periods of convulsions. If possible a physician should be secured first, so that a large hypodermic of morphin may be given.

CHAPTER VII.

GENERAL INJURIES.

SHOCK.

USED in its surgical sense, shock is a term which indicates a condition of depression of the nervous system, more or less profound.

Shock follows injury, and, as a rule, the more severe the injury the greater the shock. However, this is not necessarily true. Some patients may suffer extensive injuries in a railroad or machinery accident and show no evidence of shock, while another patient may develop marked shock after comparatively insignificant injuries.

Symptoms.—The symptoms develop slowly, usually beginning shortly after the accident, although in some cases they may be delayed for several hours or longer (secondary shock). When shock is fully developed the observer notices that the patient is either unconscious or in a stupid condition, taking no interest in his surroundings. The face is pale and anxious, with the eyelids drooping and the eyes dull with dilated pupils. The breathing is feeble and shallow, the pulse weak and rapid, the skin cold and clammy, and there is a general feeling of bodily and mental fatigue.

Shock is more apt to occur under the following conditions:

1. After severe injuries.
2. After hemorrhage.
3. After severe mental strain.
4. After exhaustion from bodily exertion, exposure or disease.

There are two elements in shock: one, the physical injury, and the other the mental strain. The fact that it may follow comparatively minor injuries has already been noted, the nervous element being well illustrated by the fact that some patients, who are doing well, go into shock after seeing their wound dressed. People in railway wrecks who see many horrible sights before being rescued are especially apt to suffer from shock.

The excitement of the moment may delay the occurrence of shock. Thus a man may work hard for hours in spite of his own injuries, rescuing other people, bandaging wounds, and otherwise making himself useful, only to develop shock after the period of excitement is over. It sometimes happens that an accident occurs a long distance from help and the patient must walk miles before securing assistance. In such cases exhaustion increases the possibility of shock.

The character of the injury may also determine the occurrence of shock. For instance, shock is much less common after injuries such as a clean-cut amputation of a leg than after crushing injuries of the foot.

Severe or long-continued pain increases shock. Thus, there is less danger when the pain of a broken arm is prevented by the use of suitable splints than whenthe patie nt is obliged to walk with the arm dangling, every step causing great pain. Morphin, because it diminishes pain, tends to prevent shock.

Treatment.—Bearing in mind what has just been said it is evident that treatment should begin with the removal of the causes which may aggravate shock. Hemorrhage should be stopped, the patient should be removed, if possible, from the immediate vicinity of the accident and measures should be taken to relieve the pain.

However, only temporary dressings or splints should be applied. We are unjustified in taking a long time to apply a splint when the patient is in a marked state of collapse. Indeed, in severe injuries it is often wiser to carry out the treatment on the spot than to attempt removal before there are signs of reaction.

Place the patient in a horizontal position with the head slightly lowered. Cover him well with blankets to preserve the body heat, and apply hot-water bottles to the feet, abdomen, and to the sides of the chest. Glass bottles filled with hot water, hot bricks, or any other form of heat will serve. Heat may be applied internally by the use of hot drinks, especially coffee or beef tea, and by the use of hot water or coffee injected into the rectum. If a thermometer is available the temperature of the injected fluid should be about 110° F., but if no thermometer is at hand the fluid may be tested by pouring it on the skin of the forearm. It should feel comfortably warm but not burning hot.

Stimulation may be given in addition to the other treatment. Aromatic spirits of ammonia, in ten-drop doses every fifteen minutes for four doses, and whisky or brandy, in teaspoonful doses every five or ten minutes for five or six doses, are suitable stimulants. Large doses of alcoholic drinks should not be given. Coffee, because of the caffein which it contains, is one of the best stimulants.

If this treatment is successful the symptoms gradually become less marked, the pulse is stronger, the breathing is easier, and the general appearance is improved. The period of shock may last only a few minutes or it may last for days. Even when early reaction occurs it is better to keep the patient warm and quiet for a while to prevent the recurrence of shock.

FAINTING.

Fainting, or syncope, is caused by lack of blood in the brain. It resembles shock except that, as a rule, there is only a trivial injury or none at all.

A person may faint after a very slight injury, such as a pin-prick or a comparatively slight blow; after an unpleasant mental impression, such as fright or the receipt of unpleasant news; after seeing something unpleasant, as the sight of blood or a wound; and when weak and exhausted, as after illness or severe muscular exertion. Fainting is more apt to occur in hot, crowded places, as theatres or churches, than in the open air.

If the above is carefully read and its relation to shock considered it will be noted that fainting results from many of the same causes as shock. The essential difference seems to be that in shock there is more or less general depression, while fainting is a circulatory disturbance of the brain—a condition of anemia of the brain.

The condition is ushered in by a sensation of weakness and exhaustion. Everyone recognizes what it means to feel faint which only differs in degree from complete syncope. If the patient is watched the face is seen to grow pale, and it is apparent that he is taking little interest in his surroundings. When questioned he is apt to answer at random or not at all. The breathing is shallow and the pulse is either very slow or very weak. Often it is impossible to detect the beating of the pulse at the wrist. As the condition develops, unconsciousness occurs and the patient falls limp to the floor.

While fainting is more common among women it may occur in men. I have seen healthy medical students fall by twos and threes at the mere sight of a particularly bloody operation, and I have frequently seen strong men faint during the dressing of a small wound. However, both men and women are more prone to faint after an illness or period of exhaustion, either physical or mental. Some persons have the fainting habit, those who faint once being apt to faint repeatedly.

Treatment.—When the first sensation of faintness occurs, complete syncope can often be avoided if the patient is given a glass of water and allowed to stand by an open window. When more active measures are necessary it is a good plan to place the patient in a chair, with the body bent forward, the head being held between the knees. This accomplishes two things: it places the head lower than the heart and allows the blood to run into the brain, and it squeezes together the contents of the abdomen, forcing the blood from the large abdominal veins into the general circulation. Try this yourself and notice how this position held for a minute or two will cause flushing of the neck and face.

If unconsciousness has already occurred the patient should at once be placed flat on his back with the head low, preferably lower than the rest of the body. Never hold a fainting person upright under any circumstances. In ordinary cases the horizontal position is all that is required, recovery soon taking place; still, the position should be continued for a few minutes so that recovery may be complete. Watch to see if paleness occurs on standing. If it does there is danger that the condition may recur and further treatment be required.

In addition to the above, for mild cases and to prevent recurrence, stimulants may be given by mouth. Aromatic spirits of ammonia, whisky or brandy, ice-water, or hot coffee may be given. Cold sponging of the face and chest and inhalations of smelling salts are additional aids.

Persons subject to fainting spells, when there is no disease of the heart, may obtain relief and diminish the attacks by daily cold sponging of the chest and face and by exercises[1] to strengthen the heart and bloodvessels. When psychic influences, such as the sight of an operation, cause faintness, it is possible to school oneself by repeatedly being present at operations, and thus overcoming the tendency to faint, and by taking the sitting position outlined above when the first feeling of faintness occurs. Once conquered the condition is not apt to recur.

SUNSTROKE.

When one is exposed to the rays of the sun or to extreme heat the tendency is toward an increase of the internal temperature of the body. Thus a temperature of 100° F. in very hot weather is not uncommon and has no special significance. The normal loss of heat is increased through increased perspiration and the rise of temperature does not become excessive. The mechanism which causes the dilatation of the surface vesssels and increased perspiration is under the control of the brain and nervous system.

After prolonged exposure to the sun the nerves which control this regulation become exhausted, with the result that the temperature of the body gradually rises, in severe cases rising as high as 110° to 112° F. This condition is known as heatstroke or sunstroke. The higher temperatures, unless

[1] One of the best exercises to cure the fainting habit consists in bending forward so the outstretched hands nearly touch the ground, and holding this position until the face is slightly flushed. Then stand erect and repeat this movement fifteen to twenty times.

rapidly counteracted, result, in a short time, in unconsciousness and death.

Symptoms.—The attacks may be preceded, for several hours or even two or three days, by certain warning signs or symptoms, such as muscular weakness and fatigue, nausea, a sensation of weakness in the pit of the stomach, headache, and dimness of vision.

As these symptoms become more marked they may merge slowly or rapidly into a state of unconsciousness. The face is flushed, the pupils are dilated, the skin is hot and dry, the breathing is labored, and the pulse overactive. The temperature (taken in the rectum or armpit if the patient is unconscious) is always considerably above normal.

Prevention.—During very hot weather the activities should be decreased, especially for a few hours around midday. Most of the work should be done in the early morning and the late afternoon, resting during the hottest part of the day.

The clothing should be cool and loose, preferably light in color, because white reflects the heat while black absorbs it. When in the direct rays of the sun the head should be shaded by a light, well-ventilated hat. Indoors the temperature of the air may be reduced by means of evaporation, such as is obtained by the use of wet sheets hung near the windows and doors, the room being kept well ventilated by electric fans.

The diet should contain little meat and few sweets. It should be light and unstimulating. Cool water should be drunk freely and frequently, but alcoholic drinks should be taken only in great moderation. Cold sponging and cool baths may be frequently taken. Warm and hot baths, contrary to the common belief, do not make one cooler, and should be avoided in very hot weather.

It is hardly necessary to add that persons already weakened by disease or exhaustion must take special precautions to avoid sunstroke.

Treatment.—If seen during the earlier period before the temperature is high or unconsciousness is present, it may be sufficient to allow the patient to rest in the shade, bathing the head, chest and wrists in cold water and giving a light stimulant such as aromatic ammonia or cold coffee.

In more severe cases where unconsciousness is present the patient should be stripped and put to bed, wrapped in a sheet wet with cold water and kept wet by frequent sprinkling with ice-water. If a clinical thermometer is available, the cold pack (or cold bath) should be continued until the temperature is below 103° F. Otherwise it is continued until the patient becomes conscious and the skin feels cool.

Fig. 117.—Showing the application of a cold-water coil in the treatment of sunstroke or other forms of congestion of the brain. (Hare.)

An ice-cap to the head, cool drinks, and massage of the body during the cooling process, are all valuable adjuncts to treatment.

The cold pack must not be too long continued or the temperature may be reduced considerably below normal. After it is stopped, watch the patient carefully. If the flushing of the face returns and the temperature rises, the cold pack should again be started, but if the patient remains pale with a normal or subnormal temperature and a weak and rapid pulse, he is evidently suffering from the secondary effects of the injury to the nerves and requires treatment to prevent secondary shock. During this stage it may be necessary to apply external heat.

After the immediate effects of the sunstroke have passed off the patient should be kept at rest for several days until recovery is complete and should avoid prolonged exposure in the sun for several months.

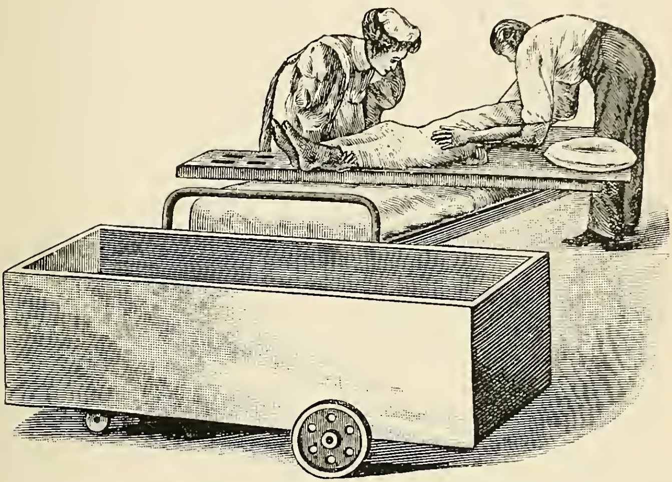


FIG. 118.—Giving a patient a cold bath for sunstroke with special square bath tub and stretcher. (Hare.)

HEAT EXHAUSTION.

This condition occurs as a result of working in a heated atmosphere,[1] especially when the physical or mental powers are exhausted or depressed.

Symptoms.—The symptoms differ from those of sunstroke and are more those of exhaustion. The face, instead of being greatly flushed, is pale or only slightly flushed, and the skin is moist and may be cool. The temperature is not increased

[1] This condition is very common in the heated boiler pits of ocean steamers, in factory firemen and in soldiers marching in heavy clothes or accouterments. It often occurs in the hot dry climate of Mexico and Arizona where, owing to the rapid evaporation of perspiration, sunstroke is uncommon.

and the pulse is rapid and weak. Temporary unconsciousness may occur.

Treatment.—As this condition is more in the nature of syncope, or fainting, the application of cold is unnecessary. The patient should be laid horizontally in a cool place and given cool drinks and mild stimulation. Stokers who are brought to deck unconscious are usually able to return to work within a few hours.

EXPOSURE TO EXTREME COLD.

The treatment of the depression due to exposure to extreme cold has already been given in the discussion of frost-bite. It may be noted that the general treatment is practically the same as the treatment of shock.

UNCONSCIOUSNESS.

Unconsciousness, or coma, is a state in which the patient is entirely oblivious of his surroundings. He is unable to answer when spoken to and cannot be aroused. In some cases the condition is only partial, that is, he may be aroused, but soon becomes unconscious when let alone. This latter condition is called incomplete unconsciousness or semi-unconsciousness. A person asleep is not, properly speaking, unconscious, because he may be awakened by ordinary means.

There is no other condition which causes the first-aid worker so much trouble as unconsciousness. It may result from so many different diseases that it is often difficult even for a physician to decide upon the cause.

We have already seen that the state may be induced by shock, fainting, sunstroke, heat prostration, snake bite, hydrophobia, tetanus, and exposure to cold. In addition it may be due to alcoholism, to head injuries, to apoplexy, to epilepsy, asphyxiation (drowning or gas poisoning), to nephritis,[1] to hysteria, and to many poisons and acute diseases.

[1] Unconsciousness due to nephritis (kidney disease) occurs in the late stages and is known as uremia or uremic coma.

In emergency cases the following conditions, in the order of their frequency, are the most often seen: fainting, alcoholism, epilepsy, head injuries, nephritis, and asphyxiation. As it is so difficult to determine the cause, it is well to adopt a plan of treatment which will be suitable for all cases until the cause can be determined.

First lay the patient upon his back and loosen the clothing about the neck. Examine first to determine the presence of asphyxiation, hemorrhage, sunstroke or poisoning, for these conditions demand immediate treatment. If there is no evidence of any of these, note the pulse and the appearance of the face. If the face is pale and cold the head should be placed lower than the body and stimulation given. If the face is flushed the head should be raised slightly and cold cloths applied to the forehead. Give the patient plenty of fresh air and loosen the clothing over the chest so as to allow free breathing.

While you are doing this send for a physician and learn from the bystanders or from friends as much as you can regarding the onset of the condition. The symptoms of the patient and the surroundings will enable you to exclude some of the conditions mentioned; thus sunstroke and freezing belong only to the extremes of temperature.

The history of a fall or blow would point to a brain injury which could be confirmed by examination of the head for bumps or wounds. Asphyxiation is at once evident if the respiratory action is watched.

If unconsciousness is not the result of an accident, find out if the patient has been drinking or has complained of being sick. Whether the period of unconsciousness started with a convulsion (epilepsy, uremia, tetanus, strychnin poisoning), or after a more or less prolonged period of illness (sunstroke, acute disease, etc.).

If you are unable to determine the probable cause of coma, you must treat the symptoms rather than the disease. If the body is cold and the face pale, give stimulants, apply external heat, and cover with blankets; but if the face is flushed and feels warm, stimulation and external heat is unnecessary.

Examine for injury, notice the odor of the breath, and search for signs of hemorrhage. If the breathing stops, begin artificial respiration and keep it up until the physician arrives.

Hysterical Unconsciousness.—This condition is the result of a functional disorder of the nervous system. The patient, usually a woman, falls to the ground apparently unconscious, but the fall is not so heedless or sudden as to result in injury. Often there is no ascertainable cause for the attack. Sometimes it is brought on by a fright or emotional shock.

The face appears normal in appearance, the eyes are closed but the lids are tremulous and attempts to open the eyes are resisted. The eyeballs are rolled upward and the pupils are normal. The pulse is normal but the respiration is greatly disturbed, possibly slow and deep or very shallow and rapid. The body may be limp or held rigid. If the hand is pinched or pain caused in any other manner the part is withdrawn but the patient can seldom be made to speak or cry out. In short, the entire appearance is that of a person who is "faking" for some unknown cause.

When the physician arrives, patients of this type are surrounded by a crowd of sympathizers who are rubbing the wrists and dashing cold water in the face and otherwise causing a great commotion. In some cases there are convulsive movements of the arms and legs (hysterical convulsions).

Treatment.—While the unconsciousness is not a true coma, yet it is due to a loss of nerve control and should not be treated as ordinary malingering. The patient should be left with one unexcitable attendant, who should not give any treatment, but should speak quietly and firmly and attempt to help the patient gain control of herself. The usual result is that after a few minutes recovery is complete. In cases which persist for some time, the opinion of a physician should be secured. Even among physicians cases are occasionally wrongly diagnosed as hysteria, later a more or less serious complaint being found which was previously entirely overlooked.

CHAPTER VIII.

SUFFOCATION.

Suffocation, or asphyxiation, is that form of unconsciousness which is due to the shutting off of the supply of oxygen to the lungs. In some cases the obstruction to the entrance of air into the lungs is mechanical. This occurs in constriction of the neck by hanging or choking, in obstruction of the windpipe by a foreign body, and the obstruction of the mouth and nose with sand or dirt or other similar material.

In other cases asphyxiation occurs as the result of the attempts to breathe air too poor in oxygen. This is seen most frequently in high altitudes and in deep mines. In mines the air is usually tested with the miner's lamp. When the lamp ceases to burn it is recognized that the air is not fit to breathe.

A similar result is seen in attempts to breathe air mixed with other gases. The gas may cause asphyxiation because it displaces the air from the room or it may be itself poisonous. For example, illuminating gas illustrates both of these principles; it is poisonous of itself and at the same time displaces the ordinary air.

In drowning, or suffocation in falling sand or dirt, there is practically no available air, so that breathing stops immediately.

A rather unusual accident has been described which illustrates a rare method of asphyxiation: A man nearly buried in a tunnel cave-in was buried in dirt and gravel up to his neck, but his head was above ground. Here, although surrounded by an abundance of air, he was unable to breathe because the weight of the dirt and sand prevented the inspiratory movement of the chest.

Treatment.—In the treatment of asphyxiation there are three steps which must be carried out:

1. The cause of suffocation must be removed.
2. Artificial respiration must be begun.
3. Accompanying injuries and shock must receive appropriate treatment.

Preliminary Treatment.—The first thing to do is to remove the obstruction to breathing. Patients should be taken from the water when drowning; carried from the smoky atmosphere in suffocation by smoke; foreign bodies should be removed from the mouth; and air-tight clothing and constricting bands removed from the neck.

FIG. 119.—Artificial respiration by Schaefer's method. By this means fluids and mucus are more readily expelled from the upper respiratory tract than in the older methods. (Hare.)

When this is done, if breathing has ceased, artificial respiration should be begun at once. Suffocation is one of the few emergencies in which a great deal depends upon the speed in which the remedial measures are carried out. While artificial respiration is being performed, an assistant can be sent for dry clothing, blankets, stimulants, or for other remedies which may be required, depending on the nature of the injury.

Artificial Respiration.—Artificial respiration consists in movement of the chest by a second person in imitation of the normal respiratory movement. Of the different methods of artificial respiration, the following three methods are the most widely known. The first is one of the best because it can be performed by one person and can be carried out over a long period with the minimum amount of fatigue.

The details of the methods of artificial respiration are as follows:

Schaefer Method.—1. The patient is placed face downward upon the floor or ground, with the arms stretched out above the head[1] and the face turned to one side, so that there is no hindrance to the entrance of air into the nose or mouth. As the tongue is apt to drop backward it should be drawn outward by inserting one finger in the mouth and hooking the tongue forward.

2. Kneel astride the subject's thighs; rest the palms of your hands over the muscles of the small of the back, the fingers spread over the lower ribs on each side.

3. With the arms held stiff, swing forward slowly so that the weight of your body is gradually but not violently brought to bear upon the patient's back. If you try this on a friend you will notice that this movement forces the air from the chest. Immediately swing backward, releasing the weight from the chest, which expands because its natural elasticity allows the air to rush into the lungs.

4. Repeat this complete movement about fifteen times a minute; that is, repeat the forward-and-backward movement, which represents a complete respiration, every four or five seconds.

5. Continue these movements until the patient breathes naturally or until a physician arrives. If no physician can be obtained keep up the artificial respiration without interruption for at least an hour.

When natural breathing returns try to time the movements to the natural breathing. It is permissible to stop occasionally for a few seconds to see if the natural respiratory movements are returning.

[1] In some cases the arms may be bent and placed at the sides (Fig. 119).

The Sylvester Method.—In this the patient is placed upon his back with a pad beneath his shoulders and the operator

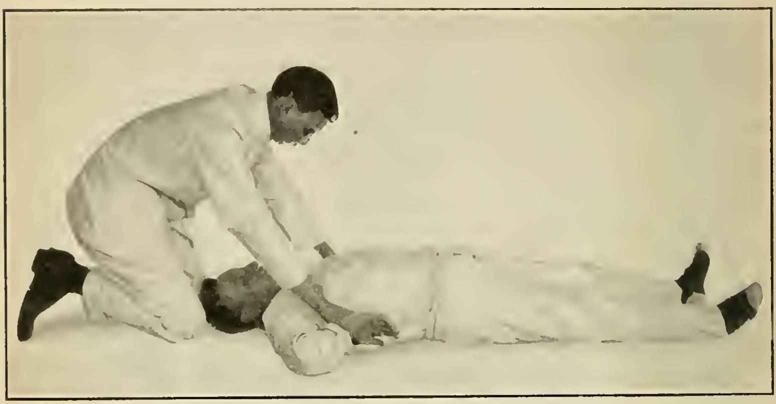


Fig. 120.—Sylvester's method of artificial respiration. First movement: the patient's arms are placed at right angles to the trunk, the elbows resting on the floor, to expand or inflate the chest. (Hare.)

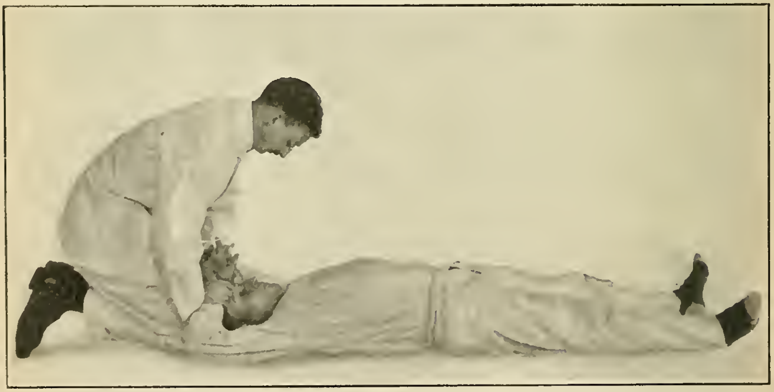


Fig. 121.—Sylvester's method of artificial respiration. Second movement: the patient's arms are drawn toward the physician, in order to expand the chest still further. (Hare.)

kneels above his head. After seeing that the mouth is free and that the tongue has not fallen back, the movements are as follows:

1. The arms are grasped near the elbows and drawn well up above the head (inspiration). They are held here for about two seconds (Figs. 120 and 121).

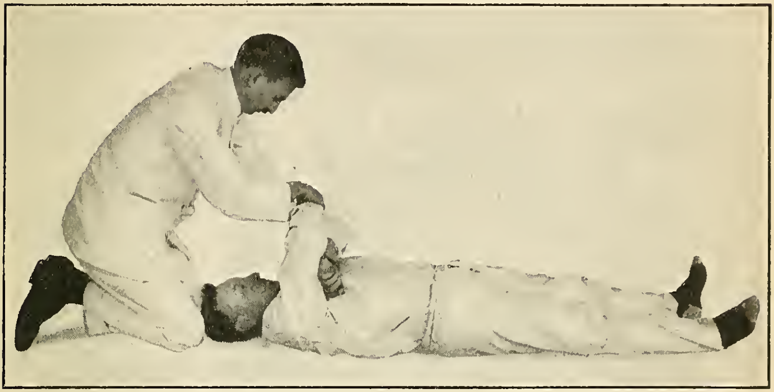


FIG. 122.—Sylvester's method of artificial respiration. Third movement: the patient's arms are raised and the elbows approximated to contract the chest.

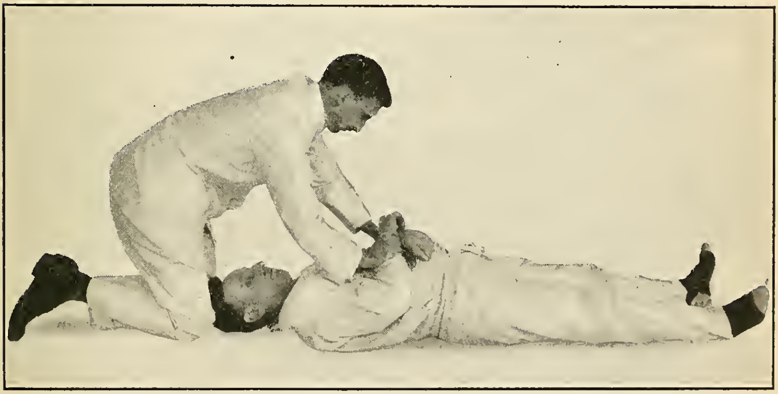


FIG. 123.—Sylvester's method of artificial respiration. Fourth movement: the patient's elbows and forearms are pressed forcibly upon the floating ribs to expel the air from the chest.

2. The arms are brought downward so that the elbows are against the chest and firm, steady pressure is made. This

movement forces the air out of the chest (expiration) (Figs. 122 and 123).

These movements should be continued about fifteen times a minute; that is, a complete inspiration and expiration every four seconds. Time yourself if possible while doing this, for, in the excitement the movement is apt to be hurried and much too fast.

The chief disadvantage of this movement is that the tongue may drop back and act as an impediment to respiration. An assistant should watch constantly to be sure that this does not occur. In addition, this method involves much harder work for the operator than the Schaefer method. If the movements are to be kept up for a long time, the operator must be "spelled" by a third person or the easier method must be chosen.

Marshall Hall's Method.—In this method the patient is placed on the floor or ground with the face downward, his forehead resting on one arm and a roll of clothing supporting his chest. While in this position the weight of the body compresses the ribs and expels the air from the chest—an artificial expiration which is increased by making pressure on the lower ribs. Then the operator, with one hand on the patient's free arm near the shoulder and the other under or in front of the corresponding hip-bone, rolls the body to the side and a little beyond. An assistant aids in this movement by handling the head and the underlying arm. When the body has been thus rolled somewhat more than halfway round, the chest becomes relieved from superincumbent weight and a certain volume of air enters. After resting a second or two in this attitude of inspiration, the patient is returned to the prone position and pressure made along the ribs to imitate the expiratory act.

Mechanical Respiration.—During recent years two mechanical respirators have been put on the market (the lung motor and the pulmotor). Both of these work on the principle of a pump, to which is attached a tube, on the end of which is a mouth-piece so made as to fit closely over the patient's mouth. When the pump has been adjusted to the patient's lung capacity the mouth-piece is placed over the patient's mouth and air forcibly pumped in and drawn out of the lungs. These machines are much better than the manual methods, but are seldom available when required.

The choice of a method of artificial respiration depends on the condition of the patient, the number of assistants, and the strength of the operators. The first is the easiest

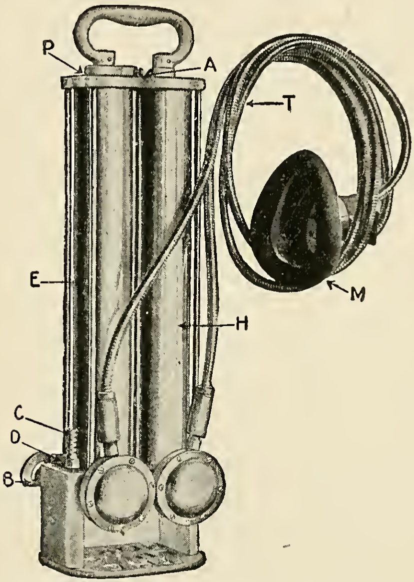


FIG. 124.—The lungmotor. One of the machines used for mechanical artificial respiration: *A*, volume gauge slide pin; *P*, pointer for gauge slide pin; *E*, inspiration cylinder; *C*, oxygen inlet; *D*, air inlet; *B*, air and oxygen mixing valve; *H*, expiration cylinder; *T*, tubing; *M*, mouth-piece.

to apply. The two latter are a little more efficacious when sufficient assistants are at hand. There is no objection to changing from one method to another, when the movements must be continued for a long time. If natural breathing returns and then ceases, begin artificial respiration again.

When consciousness returns, give the patient hot coffee or hot beef tea, and massage the arms and legs toward the heart as an aid to the circulation. Then carry him to shelter where he can rest quietly in a warm bed for several hours. Use other methods for the prevention of shock.

CHOKING.

Choking may result from constriction about the neck or from foreign bodies in the windpipe. The first requirement is the removal of any obstruction. In adults a foreign body can often be removed from the windpipe by a sharp blow upon the back, which causes a sudden expulsive movement. Children can be picked up by the heels and held head downward to dislodge a small particle which has been drawn into the windpipe or throat. If this is not successful, and the foreign body is in the back part of the throat, it may sometimes be dislodged by means of the finger introduced into the mouth.

In patients who are suffering from alcoholism or other form of poisoning, as well as those unconscious from drowning or electric shock, the tongue may fall back so as to shut off the windpipe. Always examine for this condition in any unconscious patient who is having difficulty in breathing, and, if present, draw the tongue downward with the finger inserted in the mouth.

When the throat is clear and there are no constricting bands about the neck, respiration should be resumed at once. If the patient does not begin to breathe immediately, artificial respiration should be begun without delay.

DROWNING.

The first step necessitates the removal of the drowning person from the water. This requires an expert knowledge of swimming and the various methods of supporting a drowning person in the water. It is, of course, useless to jump into deep water unless you are able to swim.

When a person falls overboard, immediately throw a life-preserver, or chair, or some other object that will float into the water and immediately summon help. Do not jump into the water yourself unless you are an expert swimmer. There have been cases where valuable time has been lost because the rescuing party has had to go to the assistance of the would-be rescuer, himself badly in need of help.

The only instance in which an indifferent swimmer is justified in jumping into the water is in case a child or other helpless person has fallen in. In such case be sure to grasp some object which will float so that the additional support will be at hand.

On reaching the drowning person, be careful not to allow him to draw you under. Swimming instructors advise hitting a panic-stricken person with the fist and partially stunning him. Support the drowning person by grasping him by the hair or clothing and holding him with the mouth and nose just above water until help arrives.

Only an expert swimmer can tow a drowning person, even a small child, to the shore.

Remove the body from the water at once and begin treatment on the spot except in very cold weather when it is permissible to move the patient to shelter if it is near.

It is difficult to say how long the patient may be submerged without death resulting. Apparently authentic cases have been reported in which the rescued person was revived after several hours under water. However, this is so improbable that the accuracy of the observation may be questioned. It is certain that submersion for more than five minutes is very apt to be fatal. On the other hand, recovery has resulted in innumerable cases where the patient was apparently dead. Consequently artificial respiration should always be resorted to, except in persons known to have been under water for an hour or longer.

The steps to be taken in the resuscitation of a drowned person are as follows:

1. Removal of wet seaweed and débris from the mouth. This is accomplished by the introduction of the finger into the back of the throat.

2. Removal of water from the lungs. The patient is placed face downward on the ground and then lifted by placing the hand beneath the abdomen so that the head hangs

downward. This allows whatever water is present to run out of the mouth.

3. Artificial respiration by one of the methods already described.

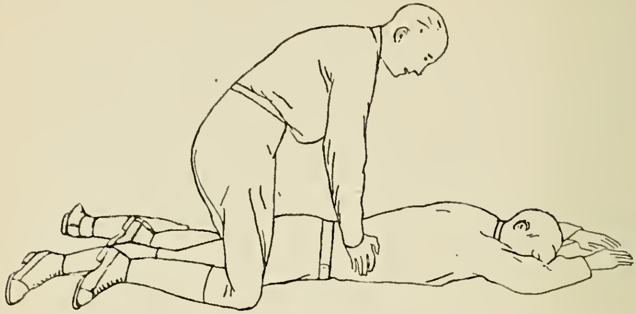


Fig. 125

Figs. 125 and 126.—Method of raising the body of a patient just removed from the water to allow the water to run out of the lungs. (Burnham.)

4. The restoration of the body heat. This can be done by the use of warm blankets and other forms of external heat.

After breathing returns the patient should be put to bed, and given warm drinks and stimulants. Pneumonia or bronchitis may follow from the irritation of the inspired water so that it is advisable to keep the patient in bed for several days after the accident.

SUFFOCATION BY SMOKE.

In rescuing a person from a room filled with smoke a moist cloth placed over the mouth will make the smoke much less irritating. It should also be remembered that near the floor the smoke is less dense than at a higher level, so that one may be able to crawl where it is impossible to walk. Fill the lungs with fresh air before entering the room and work as quickly as possible while in the smoky atmosphere.

When the rescued person is not unconscious it usually requires only a few minutes in the fresh air to revive him. When unconsciousness is complete begin artificial respiration as soon as possible after reaching the open air. In addition, sprinkle cold water in the patient's face and give stimulants as soon as consciousness returns.

The irritation of the smoke is apt to cause bronchitis and pneumonia. Consequently, it is advisable to keep the patient quiet, preferably in bed, for several days after the accident.

ASPHYXIATION BY ILLUMINATING GAS.

The ordinary form of gas asphyxiation is carbon monoxide poisoning, which is most frequently seen in poisoning with the ordinary illuminating gas. The condition comes on slowly, unconsciousness often occurring without warning.

There are apt to be preliminary headache, dizziness, and throbbing of the head in the presence of the escaping gas. Ringing in the ears and spots before the eyes may occur, but usually all the symptoms are so mild that they pass unnoticed.

In illuminating gas poisoning unconsciousness occurs early. During this stage the lips, skin, and nails take on a bluish tinge, the heart becomes rapid and weak and the respiration shallow and irregular, finally ceasing entirely.

While the above refers to illuminating gas poisoning the symptoms and treatment are very similar in poisoning with gas from coal fires, sewer gas, mine gas, and poisoning from so-called "back draught" at fires where the air is laden with carbon monoxide as a result of incomplete combustion.

Treatment.—Never take an open light of any sort into a room filled with gas, as the gas may become ignited, resulting in a dangerous explosion. Before entering a room filled with gas take two or three deep breaths of fresh air and then hold the breath until the window is reached. Open the window widely or break the glass if it does not open easily. Take another deep breath of fresh air at the open window and then search the room for persons overcome by the gas. Carry the first person found to the open air and return yourself, or send someone, to open the remaining windows, if there are any, and to make a careful search for other victims.

On one occasion I was called to attend a mother and child, overcome with gas, and on arriving I found a second child unconscious in an adjoining room, who had been completely overlooked.

When open air is reached, the respiration of the patient should be carefully observed, and, if weak or absent, artificial respiration should be started. If the patient is able to swallow, hot coffee or other stimulant should be given at once.

The unconsciousness of gas poisoning is different from other forms of suffocation. When the open air is reached the patient may revive rapidly, or unconsciousness may continue or even grow deeper. This is because in carbon monoxide (illuminating gas) poisoning the blood undergoes a permanent change which diminishes its power to absorb oxygen. Patients are sometimes seen who remain unconscious for days as a result of illuminating gas poisoning. Recovery after these long periods of unconsciousness is very rare.

After respiration has begun, means should be taken to remove the patient to the nearest hospital, where expert medical attention may be secured.[1] If this is not to be

[1] The modern treatment of carbon monoxide poisoning depends mainly upon the transfusion of blood, a surgical procedure which consists in the introduction of healthy blood into the bloodvessels of the patient.

obtained the treatment must be confined to rest in bed in a well-aired room, combined with the administration of nourishment and stimulants when the patient is able to swallow.

ASPHYXIATION BY IRRITANT GASES.

In asphyxiation by irritating gases, such as bromin, chlorin, or formalin, the chief effect is an intense inflammation of the eyes, nose, throat, and lungs. At first this makes breathing difficult. Later the inflammation may cause bronchitis and pneumonia severe enough to result in death.

In America these cases are seen only in workers in chemical factories, but in the European war such gases have been used extensively in offensive and defensive operations. For this reason the following official report is published in full. While the report contains many technicalities, it is thought better to publish it as it stands rather than to attempt to modify it in any way.

Asphyxiation by Gas in the European War.[1] — Chlorin or bromin gas, compressed into liquid form and liberated from large metal tanks when the wind is blowing toward an opposing trench, has caused very distressing deaths when inhaled in concentrated form. Being heavy gases they hug the ground, moving to leeward, and sink into the trenches. The first effect is to cause the eyes to water, and this is quickly followed by a violent irritation of the bronchial tract. If troops are unprotected and remain in the trenches they rapidly develop a capillary bronchitis, with a hypersecretion of thin watery mucus, which fills up the air spaces of the lungs and practically causes death from drowning. Those receiving concentrated doses died in from one to three hours, sometimes from edema of the glottis, but principally from exhaustion of the heart in trying to pump the blood through the engorged capillaries surrounding the bronchioles and ultimate air spaces of the lungs. This suffocating process sometimes lasts from one to three days, the younger men with stronger hearts holding out longer than the older.

[1] Surgn. A. M. Fauntleroy, U. S. Navy: Report on the Medico-Military Aspects of the European War.

The mortality from this form of suffocation depends on the degree of concentration of the gas inhaled and the age of the patient. Many cases have been mild on account of the capricious action of the wind in distributing the gas along the trenches, some parts of the line receiving it in more concentrated form than others. This results in all stages of an asphyxiating bronchitis, from the grave cases which are cyanosed and gasping for breath to those suffering from a mild form of irritation of the bronchioles. On this account some recover quickly and others, lingering for a longer period, slowly regain the normal, not infrequently exhibiting more or less marked evidence of bronchiectasis. The postmortem examinations of the lungs show them to be about four times their normal weight, with an enormous dilatation of the air spaces, which latter are filled with a thin, watery, and sometimes blood-streaked mucus.

Treatment.—As regards treatment, those in the open air seem to suffer less. Oxygen gas, administered slowly, unquestionably gives relief. Atropin, hypodermically, is used for the overdistended right heart, while the lateral prone position of the patient favors drainage of the lung fluid.

By far the most important is, of course, the prophylactic use of some form of combined helmet and respirator, which is intended not only to render the gas innocuous but also to protect the eyes. When the gas was first used it came as a surprise and there were many more victims than at present. There are a number of different types of protecting masks in use, all having for their object the neutralization of the gas when inhaled through the mask or helmet. Experience has taught that to be effective the protecting apparatus must either be in the form of a helmet entirely covering the head and tucked in at the neck, or in the form of a mask fitted snugly around the face under the chin and over the front part of the cap above the visor, by means of strong elastic tape. The mask or helmet should be made of some impermeable material, such as mackintosh, with a piece of transparent celluloid, about 8 inches long by 3 inches wide, sewn into corresponding elongated oval opening cut in the mask opposite the eyes. That part of the mask in front of the nose and mouth is punctured by about twenty-five small round openings arranged in the form of a square. Behind these openings, inside the mask, a slightly larger square piece of cloth, also punctured with holes, is sewn so as to form a pocket for a little pad, impregnated with chemicals, which is slipped into the pocket just before the mask is to be used.

The pad in this form of protector is about 4 inches long by 3 inches wide and contains an equal quantity of hyposulphite and bicarbonate of soda, distributed equally throughout the pad by a few loose stitches holding the sides of the pad together. When the protector is to be used, about one ounce of water is poured on the pad from a small bottle, the latter kept in the soldier's coat pocket for that purpose, and the pad is then slipped into the pocket of the mask just before the latter is adjusted.

The first forms of masks consisted simply of gauze or oakum, saturated with the chemicals and secured around the mouth and nose. This did not protect the eyes, which quickly became irritated, so that it was impossible to keep them open for long when the gas was concentrated. This of course, prevented the soldier from fighting in the presence of gas. It was also thought that it complicated matters by having the chemicals in solution beforehand, whereas in the form of mask described above it was only necessary to pour water on the pad before using. Several of these pads are furnished with each mask, to be kept in a tin box in the pocket along with the small vial of water. The mask form of protector is thought to be much more practicable in that it is not as disagreeably hot as the helmet form, and can be secured above the visor, when not in use, thereby making it more easily accessible at all times. Masks containing a pad saturated with lime-water or turpentine have also been used.

Not infrequently the gas may be seen from some distance as a thin greenish-yellow cloud, and it is ofttimes possible to detect the odor for an appreciable time before it becomes concentrated, thereby giving sufficient warning to allow the mask to be adjusted in time to meet the oncoming gas.

Flame projectors (flamenwerfer) are used by the Germans for throwing burning liquids. They are very much like the ordinary portable fire extinguisher in construction, throwing a liquid which at once catches fire spontaneously, and has an effective range of thirty meters (about ninety-four yards). The burns caused by this method are of the deep sloughing variety, exposing tendons and bone, and are treated with wet dressings until healthy granulations appear. These flame projectors are mainly employed in street and house-to-house fighting, although their use in the trenches has been reported a number of times. Hand grenades (bombs) and shells have recently been employed at short range to produce an irritating and asphyxiating gas on bursting. Although intended to render portions of the trenches untenable, reports from the front indicate that their action is very variable and much influenced by the presence of the wind. The necessarily small quantity of gas that is involved at the time of bursting has a very restricted local effect.

CHAPTER IX.

REGIONAL INJURIES.

Various injuries, with the exception of fracture, have been discussed generally, without regard to their occurrence in special locations. Certain injuries in one location take on special characteristics which may not be present in the same injury in other parts of the body. Thus, hemorrhage from a wound of the hand requires entirely different treatment from hemorrhage from the nose (nosebleed). In the following pages the various injuries will be classified under the different regions of the body and the discussion largely limited to the special methods of treatment that are required. While the treatment is indicated in each case it is not intended that, as outlined here, it should be regarded as entirely complete. Each case should be considered in its relation to the general discussion of the subject in the preceding pages.

HEAD.

Wounds of the Scalp.—Because of the abundant blood supply, wounds of the scalp bleed freely. The hemorrhage can usually be stopped by applying a compress and making pressure with the fingers directly over the wound. In some cases where the bleeding is especially profuse it may be stopped by tying a narrow bandage tightly about the head just above the ears. Naturally the wound should be swabbed out with tincture of iodin or other antiseptic, as has been outlined in the chapter on Wounds.

In every case of scalp wound, be on the lookout for fracture of the skull or injury to the brain. It is always advisable to keep the patient quiet in bed for several hours after every severe blow on the head.

Treatment.—If a physician cannot be obtained, shave the hair from the scalp for about an inch on each side of the wound, cleanse the wound and hold the edges together with adhesive plaster.

Infection of the Scalp.—Occasionally after insignificant injuries which have been neglected, and even after wounds sutured by skilled surgeons, infection may develop and spread rapidly beneath the scalp. This is shown by increased throbbing pain and swelling of the scalp. The swelling is not marked but is evident only through a slight thickening of the surrounding scalp which, very characteristically, "pits" on pressure—that is, when the finger is removed after firm pressure a pit is left which does not disappear for some minutes.

Treatment.—This condition is very serious and requires attention within a few hours. When no surgeon is available the wound should be opened widely by cutting the sutures and opening the cavity of the wound, so that any retained pus may escape. If the wound is small the crust should be removed with a sterile pair of scissors or a sharp tooth-pick, previously dipped in iodin. In any case a large wet boric acid dressing should be applied.

Concussion of the Brain.—This condition results from severe blows and falls upon the head. It is supposed to be due to a jarring or shaking of the brain, and the patient is said to be stunned or knocked senseless. Temporarily the brain ceases to functionate. The patient is dizzy, confused, nauseated, pale, and sometimes unconscious. The pulse is rapid and weak and the respiration is irregular.

If the condition is limited to simple concussion the period of insensibility lasts for only a few minutes. However, such after-effects as headache, weakness, and nausea may last for some time.

Treatment.—Most cases recover consciousness after a few minutes' rest, but they should be kept at rest for several hours in a quiet darkened room, the head and shoulders slightly elevated. If they show symptoms of shock, heat should be applied to the body and an ice-cap placed upon the head. Stimulants should be given cautiously in cases of head injuries.

Intracranial Injury.—In many cases after a blow on the head the symptoms are more severe, indicating a more serious injury to the brain. If the brain is pressed upon by a fragment of a bone, as occasionally happens in fracture of the skull, or if a small vessel inside the skull bleeds and the escaped blood, confined within the bony cavity, causes pressure on the brain, the result is known as compression of

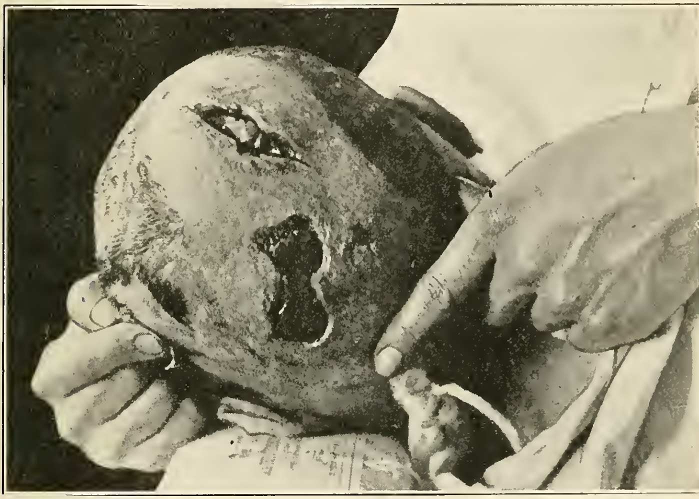


Fig. 127.—Perforating bullet wound of the head with wound of exit showing brain protrusion. (Park.)

the brain. In more severe cases the brain substance may be torn and severely injured, this condition being known as laceration of the brain. These conditions, together with concussion, are sometimes spoken of as intracranial injury, a rather loose diagnosis which indicates simply that the brain has been injured, without designating the particular type of injury present.

After a blow on the head the first-aid worker is interested chiefly in deciding whether there have been any serious consequences or whether the condition is simple concussion which will quickly pass away.

In most hospitals it is made a standing rule to keep every head injury under observation for several hours, to be certain that no serious injury is present.

Symptoms.—The mildest cases show only concussion with symptoms which clear up within a few minutes. More severe cases show the symptoms of ordinary concussion which, instead of clearing up, persist for several hours. These cases should be watched very closely for evidences of compression of the brain.

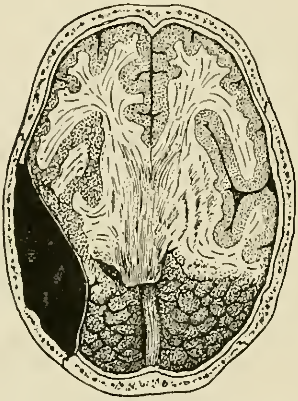


Fig. 128.—Cross-section of the head showing hemorrhage between the skull and brain, a result of a blow on the skull without fracture. (Ashhurst.)

If the injury to the skull results in the rupture of a blood-vessel in the brain the patient at first shows symptoms of concussion which may entirely disappear within a few minutes. As the torn vessel slowly bleeds, the escaped blood, held within the firm bony cavity of the skull, causes gradually increased pressure which makes itself evident in unconsciousness, deep stertorous respiration, irregular heart action, and possibly death. This is known as "compression of the brain," and is very similar to apoplexy. If the hemorrhage in the brain is from a very small vessel the secondary symptoms of compression may not occur for several hours after the injury.

In laceration of the brain, unconsciousness occurs at once and lasts for a long time. The intermediate stage of complete consciousness is practically never present.

If a patient has received a head injury he should be kept at rest as outlined under Concussion and watched for symptoms which might indicate serious injury to the brain.

If the patient grows slowly more and more stupid and unresponsive, or if semiconsciousness or unconsciousness occur after a preliminary stage of clearness, there is almost certainly hemorrhage within the skull. If there is vomiting, a slow pulse, or persistent headache, the condition is less certainly, but possibly, present.

Unequal pupils, convulsions, or paralysis of an arm or leg are bad symptoms when they occur. If any of these symptoms occur after a blow on the head, even if the injury is apparently insignificant, it is best to secure the services of a physician.

Treatment.—The treatment consists of rest in bed, with the head and shoulders slightly elevated,[1] an ice-cap being applied to the top of the head. The body should be kept warm and hot drinks may be given. Stimulants should rarely be given to a patient suffering from head injuries.

EYE.

Contusion of the Eye.—A blow in the eye results in the ordinary "black eye," the discoloration being caused by bleeding beneath the skin. Because the skin about the eyelids is very loose there may be considerable hemorrhage from a very slight blow. The dark color of the blood in the tissues (ecchymosis) persists for about two weeks, that is, until the ecchymosis is entirely absorbed.

Treatment.—The treatment consists in the application of cold compresses or cold water immediately after the blow is

[1] A convenient method of securing elevation is that of placing blocks under the head of the bed so that it is elevated about 8 to 10 inches.

received. After the second day hot applications which tend to hasten absorption, are preferable.

Wounds about the Eye.—These are apt to be associated with profuse hemorrhage. Strong antiseptics should be avoided because of the danger of injury to the eye. Boric acid in saturated solution is a non-irritating antiseptic which may be applied freely.

Foreign Body in the Eye.—Small specks of dirt and sand may be blown into the eye. Unless they rest directly on the cornea[1] there is very little pain. After a foreign body has been in the eye for a few hours the entire eye appears congested and inflamed.

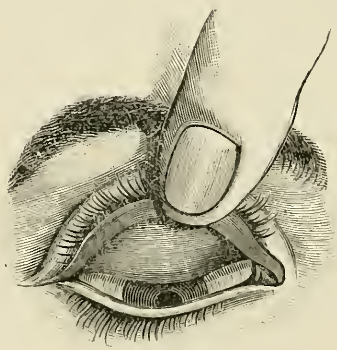


Fig. 129.—Method of holding the upper lid turned back in searching for a foreign body. (Veasey.)

Treatment.—Never rub the eye, because this only serves to increase the irritation. Blowing the nose or winking rapidly is the simplest method of removing a foreign body. If this is not successful, grasp the eyelashes on the upper lid, draw the upper lid downward, so that the lashes of the lower lid sweep the inner surface of the upper lid. Or get the patient in a good light and draw the lower lid downward, looking carefully for the speck, especially at the inner end of the eye. If it is not found, turn the upper lid backward

[1] The front part of the eyeball through which the light passes.

over a match or a small stick and look on the inner surface of the upper lid. If you are still unable to see the foreign body, it is better to send the patient to a physician. If the body is found it may be lightly brushed away with a swab made by wrapping a little cotton around the end of a match, or with the corner of a handkerchief. The inflammation which remains after the particle is removed requires frequent irrigation[1] with boric acid solution. If very severe, compresses wet with boric acid should be applied.

EARS.

Boxer's Ear.—After a blow on the ear there is sometimes a hemorrhage beneath the skin which may make the ear

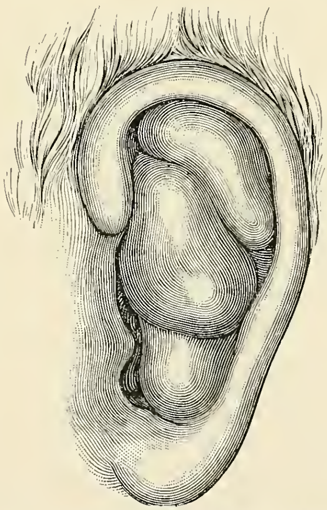


FIG. 130.—Boxer's ear. (Posey and Wright.)

several times its normal thickness. The swelling is apt to remain permanently, and, as it is common among prize

[1] To irrigate the eye the head is tipped back and the solution dropped into the eye with a medicine dropper. If an eye cup is available the solution may be poured into the cup which is applied to the eye, the head being then tipped backward and the eye winked rapidly in the solution.

fighters, it has been termed "boxer's ear." When it first occurs a firm bandage should be applied over a cotton compress so as to limit the amount of swelling.

Foreign Body in the Ear.—Children frequently push matches, beans, beads, and other small bodies into the ears. Flies and other insects may crawl into the ear during sleep.

If an insect gets into the ear it causes a loud buzzing, which is most uncomfortable. If a lighted candle is held just outside the ear while the patient is in a room otherwise dark the insect will frequently crawl out toward the light. Or warm water may be dropped into the ear, drowning the insect and stopping the buzzing. After the buzzing has stopped the ear may be gently syringed with warm water, which may finally remove the insect. Other objects, such as beads which do not swell, may be removed in the same way, but be careful not to wet pieces of wood, or beans, or similar objects, as they will swell and cause severe pain.

Never try to pick a foreign body out of the ear with a pin or other instrument. Such attempts only push the body farther in and may cause permanent injury to the ear drum.

NOSE.

Foreign Body in the Nose.—A foreign body in the nose may sometimes be removed by blowing the nose violently or by sneezing. A sneeze may be caused by tickling the nose with a feather or by the use of snuff. The patient should be instructed to keep the mouth closed during the act of sneezing.

Bleeding from the Nose.—This may follow a blow upon the nose or may occur sponstaneously. Usually the hemorrhage stops after a few minutes, but in some cases the bleeding may be severe enough to cause alarming symptoms.

Treatment.—The head should be held backward so that the nose is elevated. A little blood swallowed will do no harm. The collar should be loosened and a cold cloth or piece of ice applied to the back of the neck. This will relieve most cases. Other methods which may be tried are the placing of a piece of folded card-board beneath the upper lip; the holding of the soft part of the nose firmly together; cloths dipped in ice-water and applied to the face; and ice-water sniffed up the nose. When the clot forms, allow it to remain in place. Never allow the patient to blow the nose. This only dislodges the clots and starts the bleeding anew.

In obstinate cases a plug of cotton can be placed in the bleeding nostril to check the hemorrhage. A long strip of loose cotton should be used, not bigger than the finger, and packed back into the bleeding nostril with a blunt instrument, such as a dull lead-pencil.

An additional measure, which has never failed me even in severe cases, is the introduction of a plug of snow into the bleeding nostril. When snow cannot be secured, a piece of ice is pounded in the corner of a towel until it is of the consistency of coarse snow and then molded with the fingers roughly into the shape of a narrow cone and pressed into the nostril.

If the patient becomes faint he should lie down with the head turned to one side. If these simple measures do not stop the hemorrhage within a few minutes a physician should be called.

MOUTH.

Wounds of the Mouth.—The blood supply of the mouth and lips is very free, consequently there is apt to be profuse hemorrhage even from slight wounds. In wounds of the mouth or tongue it is impossible to apply a dressing. If large they should be referred to a physician for suture; if small the patient is given a mouth wash (peroxide of hydrogen) to use frequently and the wounds are let alone.

Hemorrhage from the Mouth.—Bleeding from the mouth may come from a wound of the mouth or throat, or it may be coughed or vomited up. Always examine the mouth carefully to see whether the blood which is spit up comes from a local injury or from some of the internal cavities, such as the lungs or stomach.

Treatment.—When the blood comes from a cut on the tongue or lip it may be stopped by direct pressure with a compress held in place with your finger. When there is persistent bleeding after the extraction of a tooth the cavity may be packed with a small plug of cotton. In most cases the bleeding stops spontaneously, but if it persists the patient may be given ice to suck and a mouth wash of peroxide of hydrogen (one-half strength).

Hemorrhage from the Lungs.—This condition is known as hemoptysis, and is commonly caused by pulmonary tuberculosis. The blood is bright red and frothy and is coughed up. The condition is rarely followed by fatal consequences, but the patient is usually greatly alarmed. If the bleeding has been profuse or prolonged the patient is pale and restless, and there are the other symptoms of internal hemorrhage.

Treatment.—Put the patient to bed with the head low and try to keep him as quiet as possible. Give him a cup in which to expectorate, so that he may spit out the blood without raising his head. An ice-cap is placed over the chest and the patient is given ice to suck. Medical attention should be secured as soon as possible. The diet should be limited to fluids, always given cold.

Hemorrhage from the Stomach.—Hemorrhage from the stomach, or hematemesis, is caused by the rupture of a vein in the stomach, or as the result of bleeding from an ulcer. The blood is vomited instead of being coughed up, as in hemoptysis, and is darker in color. In some cases it may be changed to a very dark brown, having the appearance of coffee grounds. It may be mixed with partially digested food. The general symptoms are those of internal hemorrhage.

Treatment.—The patient should be placed in bed with an ice-cap placed over the stomach. Absolutely nothing is given by mouth, not even cold water, but the patient may be given ice to suck if the fluid is not swallowed. Otherwise the treatment is the same as for internal hemorrhage.

Internal Hemorrhage.—The symptoms of internal hemorrhage are exactly the same as those of external hemorrhage, except that the blood is not seen or only part of it may appear at the surface.

In hemoptysis and hematemesis, or after a stab wound of the abdomen or chest, the diagnosis is comparatively easy;

but after injuries to the abdomen, in which there is no vomiting of blood, the diagnosis is much more difficult.

There is always paleness associated with a rapid pulse and shortness of breath (air-hunger). The hands and feet are cold, and the patient is restless and complains of intense thirst.

Treatment.—The patient is placed flat in bed and kept absolutely quiet, not even being allowed to get up to go to the toilet. If the location of the bleeding is known, an ice-cap or a cold compress is placed over this point. The patient is covered well with blankets and hot-water bags are placed against the legs and feet.

If the hemorrhage comes from the stomach, nothing should be given by mouth; otherwise cold drinks may be given. Stimulants are never given unless the condition becomes serious, in which case coffee or aromatic spirits of ammonia may be given by mouth, or coffee solution may be injected into the rectum.

The patient should be kept absolutely quiet until the physician arrives. This is one of the cases where it is dangerous to attempt to transport the patient even if a physician is not obtainable for several days. Patients receiving such injuries on the battlefield are not able to stand transportation to the base hospitals.

Foreign Bodies in the Throat.—A pin, a coin, or other small object may be accidentally swallowed. When it is drawn into the air passages it causes choking, which has been described elsewhere. If it passes down into the throat it may remain lodged there, or it may pass down into the stomach.

If it remains in the upper part of the throat it can sometimes be seen and removed. More often it is out of sight, but the patient feels it as a hard lump in the lower part of the neck.

Often if the throat is tickled the patient will vomit, the force of the vomiting removing the foreign body. If this does not occur the patient may swallow the object by taking a large drink of water or a mouthful of food. When the object is sharp, such as a pin, there is danger that the sharp point may injure the stomach or the intestines. Consequently it is advisable to give at once a large amount of some food, which is digested with difficulty, the theory being that the sharp object will pass through the intestines firmly embedded in the mass. Uncooked rolled oats or bran are excellent substances for this purpose.

CHEST.

Contusion of the Chest.—Hard blows upon the chest or sudden pressure upon the chest, such as is seen in "buffer accidents," result in a momentary cessation of respiration. The patient is unable to "catch" his breath and the face and neck become blue and congested.

Such cases usually recover after a short rest. If there is difficulty in breathing, artificial respiration should be begun. After the first effects of the injury have passed away, examine carefully for fracture of the ribs.

Wounds of the Chest.—These are important because they may penetrate the chest cavity and injure the heart or lungs.

If the *heart* has been injured the pulse is rapid and weak and the patient shows a marked degree of shock. He should be kept strictly at rest until the arrival of the physician, and the treatment given as outlined under Internal Hemorrhage. The surface of the wounds should be painted with tincture of iodin and a dry dressing applied.

When the *chest cavity* is entered the air rushes in through the opening during inspiration and is expelled during expiration. If the wound is carefully examined the entrance and exit of air can often be detected. In addition, if the lung is injured, the patient complains of cough and brings up blood-stained expectoration. If the air escapes beneath the skin a condition known as subcutaneous emphysema results, in which there is swelling in the region of the wound. This swelling is due to air in the tissues, and when pressed upon gives a characteristic sensation of crepitus.

Treatment.—The wound should be dressed with a small sterile dressing, after preliminary painting with iodin, and the entire dressing covered with adhesive plaster or other material which will not permit the passage of air. In most cases this gradually relieves the breathing; in a few cases the breathing is made worse. If the latter is the case the dressing should, of course, be removed. Otherwise the treatment is the same as for internal hemorrhage.

ABDOMEN.

Contusion of the Abdomen.—Contusion of the abdomen results in a momentary shortness of breath which soon passes away. In addition, contusion of the abdomen may result in an injury to one of the abdominal organs which may have serious consequences. The soft organs, such as the liver and the kidneys, may be torn and lacerated, in

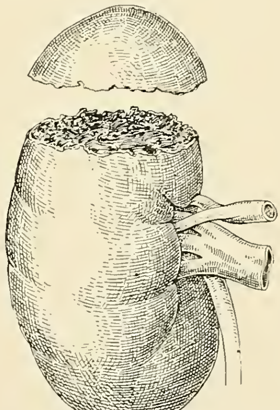


Fig. 131.—Rupture of the right kidney following blow on the back. (Ashhurst.)

which case internal hemorrhage is apt to be profuse; or one of the hollow organs, such as the stomach, intestines, or bladder, may be ruptured, with the escape of their contents into the abdominal cavity, in which case hemorrhage is less marked, but the escape of the fluid contents of the ruptured organ is apt to cause peritonitis and death.

Symptoms.—The symptoms vary with the severity of the injury There is always more or less shock, which may merge imperceptibly into internal hemorrhage; or the symptoms of shock may pass away entirely, the symptoms of hemorrhage not becoming evident for an hour or more.

When a hollow organ is ruptured there is apt to be marked and prolonged shock, with severe internal pain; but these symptoms may gradually grow less, so that after a few hours the patient feels much improved, apparently on the road to recovery. The pain and tenderness never entirely disappear, however, becoming at a later period more marked, and gradually developing into the well-defined pain and tenderness of peritonitis.

The vomiting of blood, or the passing of blood in the urine, or in the stools, all indicate injury to the abdominal organs. The inability to urinate may mean a ruptured bladder. Occurring several hours after the injury, fever and vomiting indicate peritonitis.

Treatment.—1. Treat the primary shock. This treatment has been outlined under shock. It is generally safer not to give fluids by the mouth until it is certain that the stomach is not ruptured.

2. If internal hemorrhage occurs, apply an ice-cap and give the other treatment required for this condition. It will be noted that the treatment of shock and that of internal hemorrhage are practically identical.

3. In order to avoid peritonitis, the patient should be given nothing by mouth until it is reasonably certain that there is no serious injury to the abdominal organs. If thirst is extreme, six to eight ounces of coffee solution or ordinary water may be injected into the rectum and retained. The absorption of this solution will relieve the thirst. An ice-cap over the area of tenderness serves to limit the hemorrhage, to relieve the pain, and to prevent peritonitis.

It sometimes happens that after an injury a patient, after a negative examination by a physician, a day or two later develops severe pain in the abdomen, associated with nausea or vomiting. Such a case is probably one in which there is secondary peritonitis brought on by the taking of food.

Always keep patients, especially children, who have received a severe abdominal injury in bed for a day or longer after the injury, even if they claim to feel perfectly well. If there is no pain and only slight tenderness, water, tea, broth, or other fluids containing no solid material may be taken in small quantities. Milk and fluids containing milk should not be allowed.[1]

Wounds of the Abdomen.—Punctured wounds of the abdomen should be dressed as any other wounds. They should never be probed. The possibility of internal hemorrhage and puncture of a hollow organ should be borne in mind and the treatment carried out as outlined above. Every patient with a deep punctured wound of the abdomen should be kept in bed for at least a week.

If there is a large wound, allowing the escape of the intestines, a towel moistened with warm salt solution (one teaspoonful of salt to a pint of water) should be placed over the intestines and kept moist until the arrival of a physician. If the intestines become dry they lose their vitality and may become gangrenous.

Bullet wounds of the abdomen are treated exactly the same as punctured wounds. Never probe for the bullet.

Strangulated Hernia.—A hernia, or rupture, is a protrusion of a small loop of the intestine through an opening in the abdominal wall. In the groins there are four natural openings which may be slightly stretched, allowing a loop of intestine to slip through. This is a rupture, and can be felt as a soft lump beneath the skin. Persons who have a rupture are usually aware of the fact, and wear a truss which is fitted with a pad so adjusted as to close the hernial opening and prevent the protrusion of the bowel.

It occasionally happens that the small loop of bowel gets crowded through the opening and squeezed off so that it cannot be pushed back. It is then said to be strangulated.

Symptoms.—The symptoms are severe pain, marked prostration, nausea, and vomiting. As the bowel is pinched off

[1] It must be remembered that milk, when taken into the stomach forms curds, so that, as a rule, milk is not suitable for patients who are forbidden solid food.

there is absolute constipation, which, unless relieved, ends in death.

Treatment.—The patient should be placed flat on his back with the foot of the bed elevated. The thighs are drawn up in a relaxed position and an ice-cap is placed over the rupture. The patient usually knows how to reduce the rupture himself. If he is unable to reduce it a physician should be sent for at once, because after a few hours, the bowel, if completely strangulated (that is if the constriction about the neck is tight enough to shut off all the circulation), may become gangrenous and death result.

RECTUM, BLADDER AND REPRODUCTIVE ORGANS.

Rupture of the bladder has already been mentioned under Contusion of the Abdomen. Hemorrhage of the bladder or of the organs of reproduction should be treated by absolute rest in bed combined with cold compresses over the injured parts. Contusions of the reproductive organs are apt to be followed by shock out of all proportion to the apparent injury.

Hemorrhage of the rectum, commonly the result of piles, is so common that it is often disregarded. If the symptoms are alarming the patient should be put to bed and given an enema of about eight ounces of cold water.

INJURIES TO THE EXTREMITIES.

Crushing Injuries.—The so-called mangle injuries of the extremities are very common. They are usually caused by catching the hands or feet in the cogs of machinery, the result being multiple lacerations and fractures. There is considerable shock, but often comparatively little hemorrhage. It is usually difficult to apply iodin to the entire area, so I have made it a practice to treat the cases by applying large pieces of gauze soaked in weak alcohol (25 to 50 per cent.) and loosely bandaging the whole in place. If there is considerable hemorrhage a large piece of cotton may be wrapped around the first dressing and a tight bandage applied. The cotton fits into the crevices and usually stops the hemorrhage. A tourniquet is very rarely required.

Gunshot and shrapnel wounds are very similar to these crushing injuries. The large open wounds (Fig. 132) should

FIG. 132.—Shrapnel wound of the leg necessitating amputation. (Park.)

FIG. 133.—Bullet wound of the calf showing points of entrance and exit. Five days after injury. (Ashhurst.)

be treated as outlined above. Simple bullet wounds (Fig. 133) should be painted with tincture of iodin; they are never probed.

Division of the Tendons.—In wounds about the wrist and ankle the tendons are very apt to be cut. Unless the cut ends are sewed together the use of the tendon will be permanently lost. Such an injury may result from what is apparently a very slight wound. A wound about the wrist, for example, may result in the loss of the ability to bend one or more fingers; or the fingers may remain bent, the power to straighten them again being lost. There is no pain or swelling of the finger and the joints may freely be moved by the examiner.

Treatment.—The wound should be treated according to general principles and a surgeon secured to suture the cut ends of the tendons as soon as possible. However, there is

FIG. 134.—Rupture of the tendon of the little finger. The patient is unable to straighten the finger. (Ashhurst.)

not as great urgency about this as about many other emergencies. While it is desirable to have the operation performed the same day, a perfectly satisfactory result may be obtained any time within the first few days.

Occasionally a wound is seen which heals entirely before the loss of motion is detected. In such cases incision and suture of the tendon should be performed by a competent surgeon.

Division of Nerves.—When a sensory nerve is cut there is numbness and loss of sensation in the region supplied by the nerve. When a motor nerve is cut the muscles which it supplies are completely paralyzed. Division of a mixed nerve causes both sensory and motor paralysis.

Treatment.—The wound is treated on general principles, and if a motor nerve is cut a surgeon is secured to suture the ends. If a sensory nerve is cut no attempt is made to suture it. The sensation returns after about three months, the adjacent nerves growing inward to supply the anesthetic area.

Foreign Body.—Occasionally a foreign body, such as a splinter or a sliver of steel, is introduced beneath the skin. If it can be seen, grasp it with a pair of fine forceps and withdraw it. If it is deeper, slightly enlarge the wound with a sharp knife and look for the end of the splinter. If it can now be easily seen, withdraw it. If it cannot be easily seen, dress the wound but never probe deeply into the tissues. If the splinter is large it is almost sure to cause suppuration, consequently it should be removed by a surgeon as soon as possible.

A piece of needle is sometimes driven into the hand. If it is entirely out of sight it is useless to incise to try to find it. Either allow it to remain or apply for surgical aid. Needles and other pieces of metal are located by the *x*-rays. Hypodermic needles often break off where the blade of the needle joins the screw cap. Consequently, those who have to give hypodermic injections should be careful not to insert the needle its entire length.

A fish-hook may catch in the hands or other parts of the body. If the barb is beneath the skin the point should be pushed forward so as to come out at another point. The barbed end is now cut away with a pair of wire-cutters and the hook drawn back. It is now easily drawn out of the skin.

Bullet wounds of the arms and legs should be sterilized with tincture of iodin and a dry dressing applied. Never probe for the bullet. The bullet may divide a tendon or nerve in the same manner as occurs in an incised wound.

Muscle Strain.—In lifting a heavy weight or in sudden twisting movements the muscles may be slightly overstretched and torn. This is known as muscle strain. It is painful but otherwise has no significance.

Treatment.—Massage with a strong liniment, such as chloroform liniment, and the application of heat is usually all that is required. A firm bandage may be worn for a few days if the pain is severe and if support is desired.

Rupture of a Muscle.—In some cases a muscle or tendon is torn entirely across. This happens most frequently in the biceps of the arm, the tendo-Achillis behind the heel, and the tendon attached to the knee-cap. There is severe pain and loss of strength in the affected part. As the symptoms resemble fracture it is advisable to apply a splint and keep the part at rest until the services of a physician can be secured.

Blisters and Abrasions of the Feet.—These injuries are usually the result of irritation and rubbing caused by poorly fitted shoes.

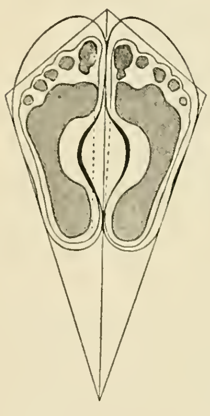


FIG. 135.—Proper soles for normal feet. (Whitman.)

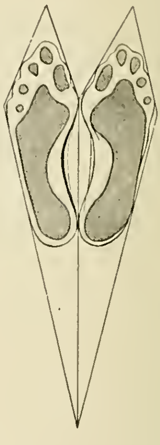


FIG. 136.—Shoemaker's feet. (Whitman.)

Sore feet may be prevented by the use of properly fitted shoes and clean, dry socks. The U. S. Army shoe, built on the Munson last, is a very satisfactory one. The ordinary shoes which cramp the feet are unsuited to the use of persons who expect to walk or stand on their feet a great deal. Soldiers on the march are required to remove the shoes after a long tramp and wash the feet, carefully drying them and changing their socks. Toe-nails should be cut squarely across but not too short.

Treatment.—Vaselin well smeared over the feet and between the toes will prevent soreness, or if vaselin cannot be obtained, talcum powder may be dusted over the feet and into the sock.

Blisters should not be opened but carefully covered with adhesive plaster. Abrasions should be well washed, dried, and painted with tincture of iodin. A small sterile dressing no larger than the abrasion is then applied and the entire dressing covered with narrow strips of adhesive plaster so that the dressing cannot slip.

Ingrowing Toe-nails.—The nail should be cut straight across, never at the side. When there is inflammation the skin is separated from the edge of the nail by packing in a small strip of cotton dipped in alcohol, after having painted the entire area with tincture of iodin. A wet boric dressing applied at night will often relieve the pain and allay the inflammation. Carbolated vaselin may be applied in troublesome cases.

Splinter Beneath the Nail.—A splinter is sometimes run beneath the nail. It should be withdrawn with a pair of forceps and a tooth-pick dipped in tincture of iodin passed along the path of puncture. This will usually prevent inflammation. If it is difficult to secure the splinter a V-shaped piece may be cut from the nail.

Blood Blisters.—These are really small contusions. The blister should be protected with a small dressing. It is never opened unless infected. Infection is shown by increased pain and redness about the blister. If this occurs, snip the thin top of the blister away and treat as an open wound.

CHAPTER X.

POISONING.

Generally speaking, anything which, when introduced into the body, causes sickness or death is a poison; but in the following pages the only poisons taken into consideration will be those which, swallowed either by accident or intent, cause acute symptoms.

Poisons are taken either accidentally, or purposely with suicidal intent. The particular poisons taken for suicidal purposes vary from year to year. Several years ago carbolic acid was largely used for this purpose, but recently bichloride of mercury poisoning is a frequent cause of death. This is because would-be suicides are apt to follow the method which first occurs to them. The frequent references to bichloride of mercury poisoning in the daily papers made the name familiar to the general public, so that when the desire to end life comes to the individual, bichloride of mercury is the first name that occurs to his mind. Without doubt in a short time there will be a particularly spectacular case in which some other form of poison is used and the resulting publicity will serve to "popularize" some other drug.

Poisons may be divided into three classes according to their action upon the human body:

1. Those which act chiefly upon the stomach and gastro-intestinal canal. These cause violent pain and irritation, first in the stomach and later in the intestines. Such poisons include caustic acids, caustic alkalies, nitrate of silver, croton oil, and sugar of lead.

2. Those which cause little or no local irritation but produce serious general symptoms, such as opium, chloral, belladonna, or strychnin.

3. Those having both local and general effects. These include bichloride of mercury, cantharides, carbolic acid, phosphorus, aconite, and animal ptomains.

Symptoms.—The symptoms vary according to the particular poison which has been taken. Irritant poisons are apt to cause severe abdominal pain, with vomiting and cramps. There may be burns or signs of irritation about the mouth and throat.

The strictly general poisons show no irritation about the mouth, nor is there accompanying abdominal pain. They act specially upon the nervous system, frequently causing unconsciousness or convulsions.

If a patient previously in good health is suddenly taken sick after taking medicine, poisoning should be at once suspected. In all cases look for the bottle! Suicides will rarely lie if asked point-blank if they have taken anything which might be poisonous. They frequently have had a change of heart and are very willing to give all desired information. In other cases the fact that they are giving evasive answers may be easily detected.

Treatment.—If an undetermined poison has been taken into the stomach the treatment is as follows:

1. Dilute the poison.
2. Empty the stomach.
3. Give an antidote.
4. Empty the bowels.
5. Support the body strength.

To Dilute the Poison.—The poison may be diluted with water or other fluid. The patient should be required at once to drink at least two glasses of the nearest harmless fluid at hand. Tepid, bland fluids are especially desirable for reasons which will be discussed later, but any fluid, such as water, coffee, soup, lemonade, beer or any other comparatively harmless fluid may be given. This serves to dilute the poison so that the local irritation is less, and at the same time to delay its absorption, so that the general symptoms are slower in making their appearance.

To Empty the Stomach.—After the poison is well diluted the stomach should be emptied. This is best done by tickling the back of the throat with the tip of the finger. It is sometimes sufficient simply to stick the finger down the throat, but this often fails, in which case the patient should be instructed to pass the finger back over the tongue until the tip barely touches the back of the throat and then to move the tip rapidly up and down. This almost invariably results in vomiting. The process may have to be repeated several times before the stomach empties itself satisfactorily.

The less time that is allowed to elapse between the time the dose is taken and the vomiting of the diluted poison the better are the chances for the patient. After the stomach is apparently satisfactorily emptied the patient is required to take two glasses of tepid water or other fluid and again to vomit. This process is repeated several times until it is certain that all the unabsorbed poison has been removed from the stomach.

Emetics are advised in poisoning and may be used if available. They are substances which when taken into the stomach cause vomiting. They take time to prepare and are infinitely inferior to the method just described. The chief emetics in common use are salt, mustard, and ipecac. A tablespoonful of mustard or a teaspoonful of salt or syrup of ipecac mixed in a glassful of tepid water will usually result in vomiting. They should be given to patients who are unable to bring on vomiting by the method just described. The same solutions may be given to patients who vomit easily, the nauseating character of the fluids making the induction of vomiting by the finger much easier. Never wait to secure an emetic, however, but give the first fluid that is at hand. One physician always gave dishwater as an emetic, saying that the mere drinking of the dishwater was sufficient to make most persons vomit. Sea water, especially if tepid, is an excellent emetic. If used skilfully the stomach-tube may be employed to wash out the stomach.

The Stomach-tube.—The stomach-tube is a medium soft-rubber tube about three feet long and about the size of the little finger. It is used to remove poisons and to wash out the stomach, or occasionally to introduce liquid food into the stomach.

It is wiser not to attempt to pass a stomach tube unless you have had a practical demonstration. The method is as follows: The patient is seated in a chair and the end of the stomach-tube, previously dipped in glycerin or olive oil, is passed to the back part of the tongue. The patient is now

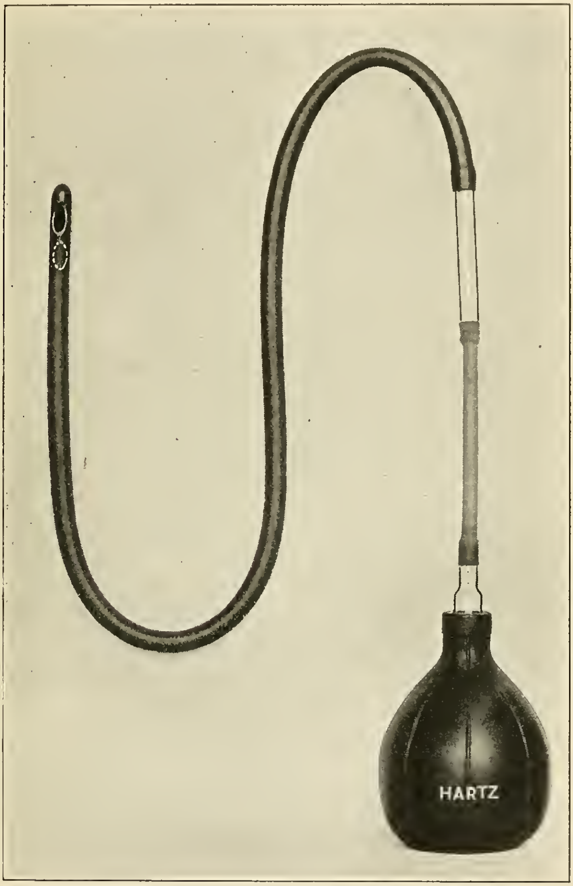


FIG. 137.—Stomach-tube and aspirator. (Aaron.)

told to close the lips and swallow, gentle pressure being made at the same time on the tube. If there is a choking sensation, or if the patient is unable to breathe, the tube should be removed. Usually it must be pushed down about fifteen inches to reach the stomach. When the stomach is reached

FIG. 138.—This tube is used without a bulb. The tube is passed and water poured into the funnel and allowed to run into the stomach. (Hare.)

a funnel can be inserted in the other end of the tube and lukewarm water poured into the stomach. After about two glassfuls have been poured down the tube the funnel is lowered and the fluid is allowed to run out. Repeated washings will remove all the poison from the stomach, but in unskilled hands this method is inferior to the method of emptying the stomach previously outlined. As it is not without danger, it should not be attempted until it has been thoroughly demonstrated by an instructor.

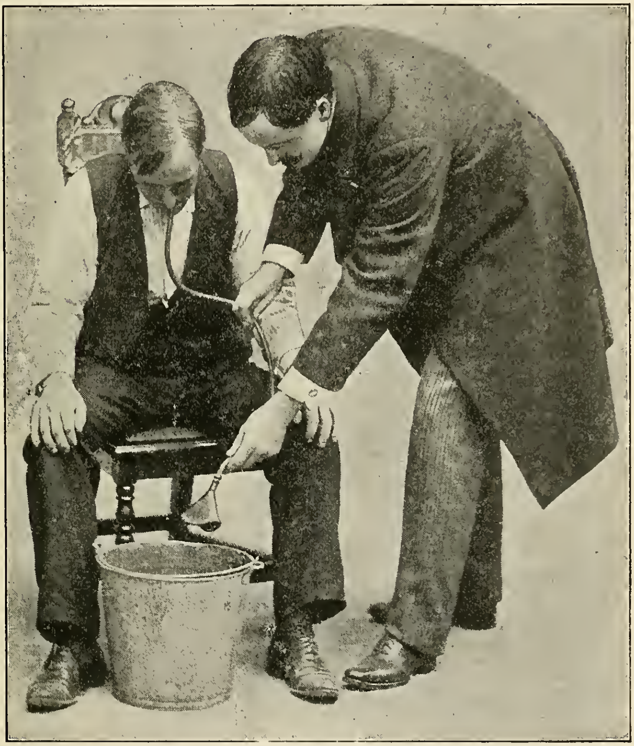


FIG. 139.—Just as the last portion of the water is about to disappear down the tube the funnel end is lowered and the contents of the stomach are siphoned out. (Hare.)

Antidotes for Poisons.—An antidote is a substance which neutralizes a poison. It may neutralize it chemically as acids neutralize alkalies, or it may neutralize it by rendering it insoluble.

While antidotes have been given third place in the treatment of poisoning it is hardly necessary to state that they should be given at once if possible. Thus milk is the antidote for bichloride of mercury and should always be given at once if at hand; but if no milk is available any other fluid may be given, the point being that it is a mistake to delay the emptying of the stomach in order to secure an antidote. Use the antidote as soon as it is at hand, but dilute the poison and empty the stomach at once by the best available means.

Certain substances are known as general antidotes, that is, they are antidotes for many poisons. Alkalies, such as baking soda or lime-water, are general antidotes for all acids (except carbolic acid), and acids, such as vinegar or lemon juice, are antidotes for all alkalies. Milk and other substances containing albumen (white of egg), are antidotes for all mineral poisons, including nitrate of silver and bichloride of mercury, as well as for all acids and alkalies.[1] Albuminous substances combine with the poison and render it less harmful, but do not neutralize it, so that the stomach must be emptied before digestion can take place. Tea, because it contains tannic acid, is the antidote for most plant poisons, such as opium, belladonna, and aconite.

Milk should always be borne in mind in case of poisoning, because it can nearly always be obtained, and it is the antidote for many poisons. It never causes harm.

To Empty the Bowels.—After the patient has vomited several times a cathartic should be given to evacuate, or empty, the bowels. No matter how quickly the stomach has been emptied it is almost certain that some of the poison has passed out of the stomach into the intestine. This portion can only be gotten rid of by the use of a cathartic, and it is advisable to use a quickly acting cathartic, such as castor oil or salts,[2] so that the poisonous material may be hurried through the bowel. Cascara, rhubarb, calomel, and all the slower acting cathartics are not suitable for this pur-

[1] Milk is less suitable for the purpose of neutralizing acids or alkalies than the chemical antidote (baking soda or vinegar), but it is an additional protection and may be given if the chemical antidote is not obtainable.

[2] Two or three tablespoonfuls of castor oil or two rounded tablespoonfuls of Epsom or Rochelle salts are the proper doses for an adult.

pose. If the cathartic is vomited the dose should be repeated after a few minutes. About an hour later a second smaller dose of the same cathartic is given, so that a good bowel movement will surely result.

To Support the Patient's Strength.—During the period of vomiting it is well to have an assistant preparing a bed so that the patient may be put to bed when the stomach is emptied.

This part of the treatment depends largely upon the character of the poison taken and the symptoms which have developed—that is, the treatment is largely symptomatic.

If the poison has caused irritation to the stomach the pain may be relieved by a tablespoonful of olive oil and by the use of a hot-water bag. If there is shock, apply external warmth and stimulants. If the patient is comatose, as from opium poisoning, slap the face and hands with cold wet cloths and try to keep him awake. If there are convulsions, keep the patient very quiet and give medicines, such as bromides and opium, to quiet the increased activity of the nervous system.

The diet should consist entirely of fluids, especially where an irritant poison has been taken. Quantities of water should be given in order to dilute that portion of the poison which has been absorbed, and must later be excreted through the kidneys.

Special Poisonings.—There are many hundreds of substances which act as poisons, only a few of which can be discussed in detail. In such cases it is to be understood that the general treatment is carried out along the plan already outlined. Some of the more common poisons, because they are frequently met with, will be discussed in more detail, attention being drawn to the special indications for treatment in each case.

Caustic Acids.—These include sulphuric, hydrochloric, nitric, and many other acids. In poisoning with caustic acids there are apt to be burns about the mouth and lips. The irritation of the stomach is marked and associated with severe abdominal pains.

When you see a case of acid poisoning, always neutralize the acid with some form of alkali. Bicarbonate of soda (ordinary baking soda) is to be found in every household. It should be given in solution, one or two teaspoonfuls in a glass of water. Lime-water or milk of magnesia can sometimes be obtained. They may be given in full strength or slightly diluted. Borax may be given in the same manner as bicarbonate of soda, but it should be given in smaller doses and should not be allowed to remain in the stomach. Ammonia is another alkali, but as it is very irritating, it should not be given if the harmless alkalies are available. Aromatic spirits of ammonia or even household ammonia, one teaspoonful to a glass of water, makes an alkaline solution which may be used to neutralize acid poisons.

Caustic Alkalies.—Including strong ammonia, potash, quicklime, caustic soda, and many others.

There are apt to be burns about the lips and mouth, but they are much less noticeable than burns caused by strong acids. The skin has a characteristic soapy feeling after strong alkalies have been applied.

Any dilute acid (except carbolic acid) may be used to neutralize the alkali. Vinegar, diluted three or four times, is one of the safest and is almost always obtainable. Sour milk, which contains lactic acid, or lemon juice, which contains citric acid, may be given. If obtainable, sulphuric or hydrochloric acid may be given in the proportions of ten to twenty drops of the concentrated acid to a glass of water.

After poisoning with either acids or alkalies the pain and burning may be somewhat relieved by small doses of olive oil at frequent intervals. Of course if the acids and alkalies are taken in dilute solutions there will be no local burns, while the gastric irritation and general symptoms will occur later and be less marked.

Carbolic Acid.—Carbolic acid, or phenol, is not a true acid from the chemical view-point. Therefore it does not neutralize alkalies and is not neutralized by them. When strong carbolic acid is applied to the skin it causes a burn. Consequently after taking strong carbolic acid, burns may be noted about the mouth. If the 5 per cent. solution, that is, the one commonly used, is taken the general symptoms will occur, but there is no local burn. The characteristic odor of carbolic acid is always present.

When strong carbolic acid (95 per cent.) is applied to the skin and immediately washed off with alcohol no burn results. Advantage is taken of this fact in carbolic acid poisoning and the stomach is washed out with dilute alcohol (10 to 20 per cent.). Whisky or brandy which are practically 50 per cent. solutions may be used diluted once or twice.

A case has recently come to my notice in which a man poured strong carbolic acid directly into his eye in mistake for boric acid. He promptly washed out the eye with alcohol, the result being that no serious injury resulted. Always remember to associate in your mind carbolic acid and alcohol.

Opium.[1]—The patient is first drowsy and later unconscious. The pupils are contracted to the size of a pin-head or smaller and the respiration is very slow, often ten or less per minute. The patient can sometimes be aroused, but soon drops off to sleep.

In addition to the general treatment the patient should be kept awake by striking the face or chest with cold cloths or by shaking him.

It is never necessary to keep the patient walking about, as was formerly believed. This only serves to exhaust the strength and serves no useful purpose.

Chloral.—This is the substance which is found in "knock-out drops," and, as may be imagined from this name, it acts very quickly. The symptoms are marked prostration, dilated pupils, shallow respiration, and a rapid and feeble pulse. Coma may result. Stimulation, combined with treatment similar to that for shock, should be promptly started. The giving of large draughts of very black coffee is one of the best methods of stimulation.

Many of the headache and sleeping powders contain drugs very similar to chloral, and consequently the treatment of poisoning with any of these drugs is practically always the same.

Strychnin.—There are general convulsions very similar to epilepsy or tetanus. There may be severe abdominal cramps. The patient is usually conscious to the end and dies

[1] Morphin is the active principle of opium and consequently the symptoms of poisoning and the treatment thereof are exactly the same.

from exhaustion after severe convulsive seizures. As these convulsions may be brought on by a sudden noise or jar the patient should be kept as quiet as possible.

I have seen a patient who had taken a large dose of strychnin sent off into convulsions by the slamming of a door or by simply touching the foot of the bed. Opium or bromides should be given in large doses if they are at hand.

Belladonna.—Poisoning with belladonna or atropin, which is its active principle, results in prostration, with full, rapid pulse and dilated pupils. The mind is hyperactive, possibly showing periods of delirium.

Elimination by the kidneys and bowels is of the utmost importance. Stimulation by hot coffee and alcoholic drinks, combined with the ordinary treatment for shock and alternating hot and cold applications to the face and chest, are all of value.

Bichloride of Mercury.—This substance, also called corrosive sublimate, is frequently taken with suicidal intent. The so-called bichloride tablets are antiseptic tablets containing about $7\frac{1}{2}$ grains of bichloride of mercury, enough to poison several adults.

The symptoms are burning and redness of the mouth and throat, with pain and irritation in the region of the stomach, possibly associated with nausea, vomiting, and diarrhea. If the patient recovers from the immediate symptoms, the mercury being absorbed into the blood must be excreted by the kidneys. As bichloride of mercury is very irritating, it gives rise to acute inflammation of the kidneys, so that they cease to function, and death results after about a week or ten days.

During this period the patient apparently recovers completely from the irritation of the stomach and throat, and the third or fourth day he may consider himself well; later the strength is gradually lost and the symptoms of nephritis develop. If the amount of the drug absorbed is not too great recovery results. In a case recently seen which received prompt treatment, enough of the mercury was removed from the stomach so that the nephritis was only of moderate degree, the patient making a complete recovery.

The treatment should aim to remove as much of the poison as possible before absorption takes place. Milk forms a temporary combination with mercury so that it cannot be absorbed, but this must be removed at once from the stomach. A large dose of salts should be given to clear out the intestinal canal as well. Bearing in mind the dangers of kidney irritation, a large quantity of water should be given to dilute the urine as much as possible, so as to minimize the irritant action upon the kidneys.

Acute Alcoholism.—It is hardly necessary to describe the symptoms of the milder degree of acute alcoholism. Drunkenness is unfortunately too common an occurrence to require much description. Moreover, first aid is not required in the earlier stages, the intoxicated person being well satisfied with his condition.

In the later stages where voluntary control of the voice and the limbs has been lost, but the patient is still conscious, the patient may be "sobered up" by the use of an emetic, such as mustard and water or salt and water, followed by a dose of salts and several cups of hot coffee. It is surprising to see how quiet the man who has been "fighting drunk" becomes after he has been given an emetic.

Alcoholic coma is more serious and may even result fatally. The face, commonly flushed and bloated, in the later stages becomes moist and pale. The pupils are dilated and the eyeballs red and congested. The coma may be complete, but usually the patient can be partially aroused. The pulse may be slow and full, but in the later stages it is apt to be rapid and weak.

There is always a strong alcoholic odor to the breath, but the converse is not always true. It should be remembered that a person who is comatose from apoplexy or fracture of the skull may have been drinking and consequently have a strongly alcoholic breath. Be careful in diagnosing alcoholism to rule out other causes of unconsciousness. When in doubt between alcoholism and apoplexy always treat for the latter, in which case vomiting is to be avoided.

If you are satisfied that you are dealing with acute alcoholism, put the patient to bed, and if the patient is able to swallow, give a good dose of salts and apply hot-water bottles about the feet and legs. If the face is flushed an ice-cap or cold cloths may be placed upon the head, but if the face is pale this is unnecessary. As long as the condition remains good there is little treatment required, but when the pulse is weak and the condition described under shock is present, black coffee should be given for its stimulating effect. If it is impossible to make the patient swallow, the coffee may be injected into the rectum.

Fig. 140.—Showing the common mushroom and one of the poisonous variety. The swollen root and sac like envelope mark the fungus on the left as poisonous.

Naturally, the stomach should be emptied if possible by the use of emetics or a stomach-tube, but emetics should not be given if the patient is in a state of extreme collapse.

Chloroform and Ether.—If the drug has been taken by inhalation no special treatment is necessary. Recovery begins at once when the drug is stopped, unless too great a quantity has been taken.

When taken internally the stomach should be emptied and the patient given stimulation. Artificial respiration is most important in these cases because the effect of the drug rapidly passes off.

Mushroom Poisoning.—There are a variety of poisonous mushrooms. Some are simply gastric irritants and some are general or systemic poisons. A few are very deadly. Never collect and eat any fungus unless familiar with its identification. The treatment is the same as for ptomain poisoning.

Ptomain Poisoning.—Foods which are partially decomposed may contain poisons, although there has been no change in their taste or odor. Milk, fish, and meats which have been allowed to stand during warm weather are specially prone to contain ptomains. Canned meats, especially when kept for several days exposed to the heat of the summer sun, may contain large quantities of poisons.

Symptoms.—The symptoms do not make their appearance immediately after taking the poisonous food. There is usually a period of an hour or more after eating during which the patient has no symptoms. Then nausea occurs, associated with vomiting and followed by abdominal cramps. Later purging begins with frequent and watery movements. As a result there is marked prostration. It is characteristic of ptomain poisoning that several persons in the same family are taken violently ill at about the same time.

Treatment.—The treatment consists in emptying the stomach as soon as nausea occurs. When a person, who has been perfectly well, suddenly develops nausea after taking food it is almost a certainty that something in the food is acting as a poison, and the sooner the stomach is emptied the better. Do not try to control nausea under these circumstances, for if the poison enters the intestinal canal it will cause more trouble than it has in the stomach.

After the stomach is emptied a dose of castor oil should be given, or if this is not at hand give salts or some other form of catharsis. Meanwhile the patient is put to bed, warmth applied, and stimulants given if necessary. In this connection it may be noted that it is unwise to try to check an acute attack of diarrhea before giving a cathartic, preferably castor oil. After the cathartic has had time to act, paregoric may be given in teaspoonful doses (for an adult) every three or four hours in order to control the diarrhea.

Ready Reference Table of Poisons and Antidotes.

The following table contains suggestions for the proper treatment of those forms of poisoning most likely to occur:

POISON.	TREATMENT.
Nature unknown	Provoke repeated vomiting; Give bland liquids; Stimulate, if necessary; keep up breathing.
Acids— Sulphuric, Nitric, Hydrochloric, Oxalic,	Give an alkali (soap, soda, and whitewash usually at hand); limewater; magnesia; Provoke vomiting; avoid stomach-pump; Give ice cream and bland fluids; Secure rest; relieve pain by opium; Stimulate, if necessary; Feed by enema.
Hydrocyanic Acid and *Potassium Cyanide*	Stomach-pump or emetic; Stimulate; potassium permanganate; Give dilute ammonia-water—by intravenous injection, if necessary; chlorine-water; Cold affusions; Give atropine, gr. $\frac{1}{60}$, hypodermatically.
Carbolic Acid and *Creosote*	Give Epsom salts, dilute sulphuric acid; atropine, hypodermatically; Stomach-pump or emetics; White of egg; amyl nitrite; Stimulate; artificial heat.
Alkalies— Ammonia, Soda, Potash, Lye,	Give vinegar, lemon-juice, or orange-juice, or other acid or a fixed oil; Give bland liquids; Secure rest; relieve pain by opium; Stimulate, if necessary.
Arsenic— Paris green, Scheele's green, Fowler's solution,	Stomach-pump or emetics; Give hydrated oxide of iron or dialyzed iron and magnesium oxide; Give dose of castor oil; Secure rest; Stimulate, if necessary.
Acetate of Lead	Stomach-pump or emetics; Give Epsom salt or dilute sulphuric acid; Milk, raw eggs, and water; Morphine hypodermatically for pain; Potassium iodide to eliminate the drug.
Mercury, Corrosive sublimate, Antimony, Tartar Emetic,	Emetics; careful lavage; Give some infusion containing tannic acid; Give raw eggs and milk; bland liquids; Give dose of castor oil; Stimulate, if necessary.
Copper Salts	Give albumin (milk, raw eggs); yellow prussiate of potassium; Stomach-pump or emetics; Give bland fluids.
Phosphorus	Provoke vomiting by repeated five-grain doses of sulphate of copper; Potassium permanganate ($\frac{1}{4}$–$\frac{1}{2}$ per cent.); Give dose of magnesium oxide, but *no* oil.
Nitrate of Silver (lunar caustic),	Give strong salt and water; Provoke vomiting; repeat many times.
Iodine	Stomach-pump or emetics; Give gelatinized starch and water; Give bland fluids.

POISON.	TREATMENT.
Opium— Morphine, Laudanum, Paregoric, etc.,	Stomach-pump; emetic; potassium permanganate, by mouth; adrenalin: ammonia; hot strong coffee by the bowel; atropine, cocaine, or strychnine hypodermatically; oxygen-inhalations; artificial respiration; lingual traction.
Chloral— Paraldehyde,	Stomach-pump or emetic; artificial heat; massage; stimulate; strychnine; amyl nitrite; artificial respiration.
Nux Vomica— Strychnine, Picrotoxin,	Stomach-pump or emetic; animal charcoal or tannic acid; bromide and chloral; amyl nitrite; chloroform by inhalation; artificial respiration.
Aconite— Veratrum viride,	Stomach-pump or emetic; stimulate; heat; atropine; artificial respiration.
Hemlock, *Toadstool*, *Tobacco, etc., etc.*,	Provoke vomiting and give a purge; tannic or gallic acid; Stimulate well; keep up breathing.
Belladonna or *Atropine*, *Hyoscyamus* or *Hyoscyamine*, *Duboisia* or *Duboisine*, *Stramonium* or *Daturine*,	Stomach-pump or emetic; stimulate; Enema hot strong coffee; artificial heat; morphine; pilocarpine; physostigmine; artificial respiration.
Alcohol	Stomach-pump or emetic; Give ammonia and water.
Decayed Meat or Vegetables	Provoke vomiting; wash out stomach; Give a purgative; give an enema; Give powdered charcoal and hydrogen dioxide.
Poisonous Gases— Carbonic acid or oxide, Sulphuretted hydrogen,	Fresh air; oxygen; Artificial respiration; Amyl nitrite or nitro-glycerin; Stimulation.

CHAPTER XI.

EMERGENCY TREATMENT OF DISEASE.

The first-aid worker may be called on for advice in case of illness due to disease. Thus a patient previously perfectly healthy may suddenly develop fever, the question immediately arising as to the best plan of management of the condition until a physician can be secured. A man known to be suffering from kidney disease may suddenly have a convulsion, or a stranger may suddenly fall unconscious either with or without convulsions. All these cases have special indications, and if they are not skilfully treated disastrous results may occur.

I have in mind the case of a boy who, while suffering from a rather mild attack of influenza, was allowed to ride about ten miles in an open automobile in midwinter to see a physician, the result being that pneumonia developed, which ended fatally. In another case a man had a severe chill due to malaria. As there were no means of transportation he was obliged to walk home, a distance of about two miles. As a result of the severe strain upon his heart, death resulted soon after he reached home.

Even a slight knowledge of the emergency treatment of disease would have prevented both of these deaths. It is not expected that the first-aid student will be able to diagnose the various diseases which may occur, but only that he will recognize certain symptoms which commonly occur and that he will outline an emergency treatment which will, at least, do the patient no harm, while it will probably do much good.

FEVER.

A rise in temperature is one of the commonest symptoms of disease. It occurs in ordinary colds, bronchitis, influenza, local cellulitis, inflammation of the intestines, tonsillitis, malaria, and in numerous other diseases. Often when a physician first sees a patient, fever is the only symptom, the characteristic features of the particular disease not becoming evident until several days later.

Symptoms.—Fever may be recognized by a flushed face, a sensation of weakness, rapid pulse, and increased body temperature (shown by the clinical thermometer). A temperature from 100° to 101° F. indicates a mild fever, from 101° to 103° F. is a moderate rise, and temperatures of 103° F. or above are considered high. Every first-aid student should be accustomed to the use of the clinical thermometer.

Treatment.—The treatment consists of rest, preferably in bed, and in the strict avoidance of exposure or muscular fatigue. To allow a person with fever to go out in the cold and wet or to continue his work is nothing less than criminal. Many cases of pneumonia and other serious conditions can be avoided if febrile patients are put to bed at once.

In the United States Army, where the soldiers receive free medical treatment and do not lose their pay when sick, serious disease conditions are often prevented, because it is the custom to send soldiers who have the slightest fever to the hospital at once. In private life, on the other hand, men struggle to fight off the impending illness mainly because their pay stops when they are away from work, the consequence being that they struggle on, continually growing sicker and weaker, until they are finally obliged to stop, the condition then being much more serious than the original complaint.

In addition to rest a cathartic may be safely prescribed and the patient put on a fluid diet. He should be encouraged to drink water freely. In many cases of influenza, or mild gastro-intestinal fever, the treatment above will result in a complete cure within a few days.

CHILLS.

When the temperature rises suddenly the patient has a chill, when it falls he sweats profusely; consequently, if a patient complains of marked chilliness, or if there is a real chill, we may suspect that the temperature is rising, and conversely when a febrile patient breaks into a sweat we may conclude that the temperature is falling.

In malaria this process is clearly shown. There is first a chill, during which the sufferer complains of extreme cold, followed by a short period of high temperature, in which the symptoms of fever are present. After a few hours the body breaks out into a sweat and the temperature falls again. When the temperature reaches normal the patient feels weak, but otherwise perfectly well.

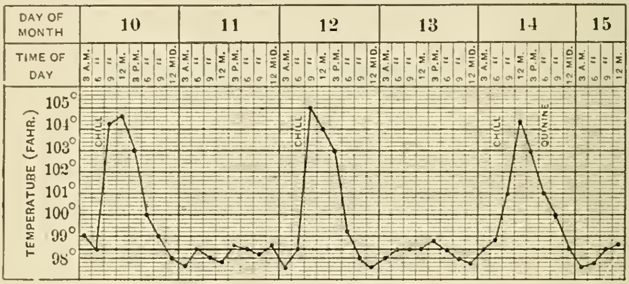


FIG. 141.—Temperature chart in malaria, showing the course of the fever with chills every other day. Notice that the rise of temperature is of short duration. (Osler.)

Chills may occur at the onset of any acute fever (especially pneumonia), and are of common occurrence in malaria and septicemia (blood poisoning).

Symptoms.—The symptoms during a chill are a sense of extreme cold, even when in warm surroundings, together with a rapid pulse, weakness, and a rising body temperature. The hands and feet are cold and the face is pale or even blue.

Treatment.—The treatment consists of rest in bed with as many covers as are desired and several hot-water bottles applied about the body. Hot coffee and hot broth may be given freely. As soon as the febrile stage is reached, as shown by the flushing of the face and the warmth of the hands and feet, the extra covers and hot-water bottles should be removed from the bed. Should sweating occur it should be allowed to proceed for about half an hour, and then the body should be well dried with a warm, rough towel and warm, dry clothing put on. Of course no patient who is suffering from any stage of a chill should be allowed to continue at work or to be exposed to cold or wet.

CONVULSIONS.

Convulsions occur in many different conditions. They are seen frequently in epilepsy, nephritis, and injury to the brain. In young children convulsions are more common than in adults, frequently occurring instead of a chill at the onset of an acute fever. In an adult previously well and suddenly seized with a convulsion the first thing to suspect is an epileptic fit. Next in frequency are apoplexy, fractured skull, and nephritis. In a child a "spasm" usually means an acute fever or gastro-intestinal disease. In later childhood, that is, after puberty, convulsions are less common, epilepsy being practically the only cause of this condition.

Treatment.—In the case of a convulsive seizure of unknown origin a physician should be sent for at once and the patient prevented from doing himself harm. The clothing should be opened at the neck and the patient placed quietly in bed. If the face is flushed, apply an ice-cap or cold compress to the head. If the face is pale, external heat may be applied. When the patient is able to swallow, a dose of salts should be given. Nurses and trained attendants are usually permitted to give a few whiffs of chloroform or a hypodermic of morphin to a patient having a prolonged convulsion. While the use of these powerful drugs without an order from a physician is generally not permitted, it might be justified in such cases. Fortunately, in most cases, convulsions are of short duration and little need be done. After the spasm has ceased a cathartic should be given and the patient kept quiet and warm between blankets.

EPILEPSY OR FITS.

In common parlance the term "fits" refers to epileptic convulsions. These are due to a state of increased nervous irritability of the brain, the cause of which is not clearly understood.

Symptoms.—A person who is subject to epilepsy can generally tell when an attack is about to occur by a peculiar sensation which he experiences. Following this the face becomes pale and the eyes dull and staring.

The attack usually begins with a sharp cry, possibly a piercing shriek, following which the sufferer falls unconscious to the ground. The entire body is first held rigid, the face becomes congested, the tongue may be bitten and bleed, and the eyes are turned upward. Convulsive movements start, often in the hands and feet, soon spreading to the entire body. The attacks rarely last for more than a few minutes, but several attacks may follow each other with only short intervals. After the attack the patient lies back relaxed for several minutes before he opens his eyes and answers questions. At first he is dull, the mind clouded, and if left alone he will sleep for an hour or more. Very rarely after an attack he may be excited and violent.

Treatment.—The patient should be allowed to lie flat wherever the fit occurs, care being taken to see that he does not injure himself. A folded coat or pillow may be placed under the head and there should be just sufficient restraint to prevent the patient injuring himself against sharp stones or other hard objects nearby.

If there is a tendency to bite the tongue a folded handkerchief or a cork may be held between the teeth.

Do not attempt to give stimulants, for swallowing is impossible, and fluid introduced into the mouth is apt to enter the windpipe and cause strangulation. Do not attempt to "break the grip" or forcibly to prevent the convulsion. Such an action accomplishes no good purpose and may even cause injury.

After the fit is over the patient should be allowed to sleep for several hours in a cool room. If the patient is violent following the convulsion, manual restraint should be resorted to. Bromides are given to prevent the recurrence of the attacks.

CONVULSIONS IN CHILDREN.

As has been mentioned before, these attacks in young children are sometimes due to disturbance of the gastro-intestinal tract, or they may occur at the beginning of an acute disease. Severe irritation of the bowels, such as is caused by the eating of a large quantity of berries, is a frequent cause, so that many of the cases are seen in the country during the wild-berry season.

Some children are specially prone to convulsions, an attack occurring at the onset of every febrile attack. The habit is usually outgrown by the end of the fifth year. While the appearance of a convulsion in a child always causes great alarm, the child is really in little danger, serious consequences being extremely rare.

Treatment.—The treatment consists in remedies which decrease the irritability of the nervous system, combined with those which quickly empty the intestinal canal. The first of these indications may be met by the use of a warm bath or by wrapping the child in a blanket previously wet with hot water, care being taken not to burn him. A cold cloth may be placed on the head. To empty the intestinal canal, two or three teaspoonfuls of castor oil may be given as soon as the child is able to swallow. If possible an enema should be given at once.

When the convulsion is over the child should be put to bed and kept perfectly quiet in a darkened room. Any attempt to move him, or unusual noises or excitement, may cause a recurrence of the convulsion. Nothing but water should be given by mouth for at least twenty-four hours.

CHAPTER XII.

COMMON EMERGENCIES.

There are, in addition to the injuries and diseases already discussed, many minor emergencies which may be greatly relieved by intelligent first aid. In the following pages several of the more common conditions will be described and the emergency treatment outlined.

The mistake should not be made of supposing that the following pages describe fully all the necessary treatment for any given case. The treatment outlined is emergency treatment only and, if the condition is severe, should not lead to a false sense of security.

In most cases the complaint requiring treatment is only a symptom, and is treated as such. Thus, nausea might be due to poisoning, to gastritis, to appendicitis, and to numerous other conditions. Consequently, the treatment for nausea does not usually cure the original disease but only relieves the patient temporarily until professional advice may be secured. On the other hand, in some cases the relief of nausea would cure the disease. For example, if the nausea is due to mild ptomain poisoning the relief of the nausea by vomiting results in cure. However, it must be emphasized that, while treatment will sometimes result in complete recovery it is wiser except in very mild cases, to secure professional advice whenever possible.

HEADACHE.

Headache is one of the commonest forms of pain which requires relief. It may be due to eye-strain, to indigestion, to constipation, and to many other conditions. Persistent headache is frequently the result of kidney disease.

Treatment.—The treatment depends largely upon the cause. It is usually advisable to give a cathartic even if there is no constipation. This is because there may be poisons in the intestinal canal which are, to a certain degree, responsible for the headache.

The patient should be put to bed in a darkened room, a cold compress or an ice-cap applied to the head, and allowed to sleep if possible. I have had patients who invariably secured relief if they drank several glasses of water, and others who were equally certain that a hot foot-bath relieved the pain. Both of these simple remedies may be tried.

If there are symptoms of indigestion a quarter of a teaspoonful of bicarbonate of soda, dissolved in water, or a few soda-mint tablets, may be taken. The ordinary Seidlitz powder "settles" the stomach and, at the same time, acts as an efficient cathartic.

The various headache powders which are widely advertised contain drugs that depress the heart. None of them are free from danger.

Aspirin, 5 grains, or phenacetin, 5 grains, are less harmful than most of the advertised remedies. The dose may be repeated, once if necessary, after an interval of an hour or more.

TOOTHACHE.

The surest way to prevent toothache is to prevent decay of the teeth. The teeth should be well cleansed, preferably after every meal, but at least twice a day. A good, stiff brush and a suitable powder or paste should be used in order to thoroughly cleanse every crevice about and between the teeth. Dental floss passed between the teeth will remove many particles of food which cannot be reached by the brush.

Toothache may be due to irritation of an exposed nerve, either by the acid formed in fermenting or decomposed food, or by heat or cold; or the ache may be the result of an actual infection about the root of the tooth (ulcerated tooth).

Treatment.—The treatment begins with the thorough cleansing of the tooth cavity with a toothpick swab, formed by wrapping a small piece of absorbent cotton about the end of an ordinary toothpick. When the cavity is clean a small wad of cotton, previously dipped in oil of cloves, or strong phenol, should be placed directly in the cavity.

Counter-irritation may be applied to the gum adjoining the tooth. For this purpose, tincture of iodin, painted on the gum, or a toothache plaster may be used. A piece of cotton wet with spirits of camphor and placed between the gum and the cheek is a very satisfactory method of securing counter-irritation.

In addition, a hot-water bag or hot cloths may be placed against the cheek over the affected tooth.

The treatment as outlined above will often relieve the pain, but it is important that a dentist should be seen and the tooth receive adequate treatment as soon as possible.

When true infection is present the tooth is commonly said to be "ulcerated." This means that there is a little abscess at the root of the tooth. When a tooth is exquisitely painful and the surrounding gum tender to touch it is probably ulcerated. This condition may exist in a tooth which is apparently satisfactorily filled and is apt to progress steadily until the pus points or the tooth is extracted.

The treatment for an ulcerated tooth is the same as for toothache. A dentist can often relieve the pain by boring a hole down through the center of the tooth and allowing the pus to escape. When the condition progresses until the pus points (gum boil) the abscess may be opened by a physician. The after-treatment depends on how badly the root has been injured. A skilful dentist will sometimes save the tooth.

NEURALGIA.

Neuralgia when occurring in the face may be mistaken for toothache. It may be due to some sort of nerve irritation, as from a decayed tooth, or from a foreign body in the nose; or it may occur without apparent cause. The pain is limited to one side of the face and the attacks are apt to recur, more or less frequently, in persons subject to the disease.

Treatment.—Hot applications usually afford relief. Hot-water bags, hot compresses, or heat in any form may be applied. In a few cases cold cloths or an ice-cap are more grateful to the patient. Counter-irritation with oil of wintergreen or menthol will give relief in some cases. Aspirin or phenacetin used as outlined under Headache may be tried. Many cases are so severe and persistent that they are relieved only with great difficulty.

EARACHE.

Earache usually occurs as a result of a "cold," the pain being caused by the collection of mucus within the ear, which, in turn, causes pressure on the sensitive eardrum.

Treatment.—In the early stages, before the pain becomes severe, the condition may be relieved by the external application of heat. A hot-water bag may be held to the side of the head or a small bag of salt or sand thoroughly warmed may be put against the ear.

If the pressure of the mucus is sufficient the eardrum may rupture. This will be shown by the discharge of a few drops of bloody mucus or pus and the immediate relief of pain. If this occurs the ear should be carefully washed out by syringing it several times daily with a warm boric acid solution (4 per cent.), care being taken to have the syringe and the solution sterile.

An earache should never be neglected, especially if associated with fever. Spreading of the infection from the ear to the surrounding bone may result in mastoiditis. Consequently, a physician should always be summoned when an earache is at all severe.

In children the pain of a decayed tooth will sometimes be mistakenly referred to the ear.

CONJUNCTIVITIS.

Conjunctivitis is associated with redness and congestion of the eyeball and the inner surface of the lids. There is usually a slight burning sensation and the eyes are sensitive to bright light.

It may occur after sunburn or exposure to extreme heat or irritating gases. An infectious type (pink-eye) may occur in one or both eyes, either alone or associated with a cold in the head.

Treatment.—The milder cases may be treated by the application of cold compresses to the eyes. These are prepared by folding small pieces of gauze, or soft linen, into two-inch squares, three or four layers in thickness. Several of these compresses are prepared and placed either on a piece of ice or in ice-water. The excess of water is squeezed from one of the compresses, which is then placed on the closed eye. After remaining in place for about two minutes the compress is removed and again placed in the ice-water, while a fresh compress is placed upon the eye. This may be done by the patient or by someone else. It should be kept up for about twenty to thirty minutes and repeated three or four times daily. In addition, the eyes should be washed out several times daily with boric acid solution (2 to 4 per cent.). Never use a poultice of any kind upon the eye nor bandage on a wet compress.

STYE.

A stye is an infection of one of the hair roots of the eyelash. It is practically a small boil. In the early stages it may be sometimes driven away by the use of cold compresses or by bathing the eye with very cold water. When partially developed hot compresses are preferred. They are used in the same manner as the cold compresses referred to above, except that they are kept in hot water instead of cold. The water should be tested with the hands. If the compresses can be squeezed out without burning the hands they cannot injure the eyes.

As the stye becomes fully developed it should be opened by a physician to allow the pus to escape.

BOILS.

Boils, or furuncles, are very common about the back of the neck, but they may occur anywhere upon the body. A boil begins as an infection about the root of a hair and occurs with especial frequency on the back of the neck, because at this point the neck is apt to be irritated by a starched collar. For this reason they occur in this location almost invariably in men.

When the pus from a boil is rubbed on the skin the infection is introduced at another point and a second boil results. In this manner a single boil is apt to result in several reinfections, the pus from the first boil contaminating the collar of the coat or overcoat, which infects the neck at a new spot.

Fig. 142.—Carbuncle of the neck of two weeks' duration. Shows little tendency to heal. (Ashhurst.)

Treatment.—When the boil first appears it may be sometimes cured by inserting a sharp-pointed toothpick dipped in phenol (95 per cent.) into the center of the boil for about one-eighth of an inch. If this is not successful the boil should be opened. It is never necessary to wait for it to point. The earlier the boil is incised the sooner it will get well. If a physician is not available a continuous wet dressing of boric acid may be applied. This acts as a poultice and tends to cause the infection to point, but it is much inferior to treatment by incision.

In order to prevent reinfection a starched collar should not be worn until the boil has entirely disappeared, and great care should be taken to prevent the pus contaminating the collar of the coat or overcoat. In a few cases boils occur as an early sign of diabetes.

CARBUNCLE.

This is a local infection similar to a boil, but much more severe. It is really a multiple boil. Carbuncles occasionally occur as a complication of diabetes.

The surface of the carbuncle shows several openings, each exuding pus. The condition tends to spread rapidly.

Treatment.—A wet dressing of boric acid solution may be applied until a physician's services can be secured. Most physicians excise the entire carbuncle.

HICCOUGH.

This is due to the spasmodic contraction of the diaphragm, the large flat muscle which separates the chest from the abdomen. It is usually due to irritation of the stomach following the ingestion of too much or unsuitable food.

If a deep breath is taken the diaphragm is forced downward and the spasmodic contraction cannot take place. Consequently, if the breath is held as long as possible the hiccough may not recur. Sometimes a little plain or carbonated water will stop hiccoughs. A few soda-mint tablets or a little hot ginger tea may relieve the indigestion and thus relieve the spasm. If these methods fail and the hiccough is troublesome and persistent the patient should be made to vomit, thus removing the cause of the irritation.

SORE THROAT.

This condition may occur associated with a generalized inflammation of the respiratory passages as part of a cold, or it may be due to tonsillitis or diphtheria.

Treatment.—A hot alkaline gargle of bicarbonate of soda or borax is one of the best methods of treating a sore throat of doubtful origin. Sodium bicarbonate solution made by dissolving one teaspoonful of the powdered drug in a glassful of water makes a solution of the proper strength. Borax may be used in the same proportions. These solutions are soothing and, being used hot, tend to stimulate the tissues and aid healing.

In addition, a cold compress should be applied to the throat. This is arranged as follows: A soft piece of flannel, folded so that it is about three inches wide and just long enough to reach about the neck, is wrung out of ice-water and fastened snugly with safety pins about the neck. A second piece of dry folded flannel, a little larger than the first, is wrapped about the wet compress and pinned at the back. If flannel cannot be obtained a soft piece of linen or cotton can be used. An old piece of toweling serves admirably in an emergency.

In about twenty minutes the compress will be warm, acting as a poultice. It is advisable to change the compress every hour or two during the day, but it is not necessary to disturb the dressing during the night.

As in other similar infections a cathartic may be given at the onset of the disease.

COLDS.

At the onset of an acute cold the infection can often be cured by a hot foot-bath, and a hot lemonade, combined with rest in bed. In addition, active catharsis with castor oil or salts is indicated. Water should be taken freely, increasing sweating and urination and thus aiding elimination.

A little vaselin placed in each nostril will relieve the breathing. This is soothing to the inflamed mucous membrane, and tends to assist healing.

HOARSENESS.

This is due to inflammation of the vocal cords (laryngitis). It may occur as a result of irritating gases or as a result of overstrain, as after prolonged talking or cheering. Ordinarily it occurs as part of an acute infection (colds, tonsillitis, bronchitis, etc.).

Treatment.—The same treatment should be carried out as outlined under Colds. The voice should be rested, talking being avoided as much as possible.

Inhalations of steam are most soothing. They may be given by arranging a paper funnel over the nozzle of a kettle and inhaling the steam. A teaspoonful of compound tincture of benzoin added to the boiling water makes the steam more effective.

Syrup of ipecac, 15 drops every two or three hours, and a cold compress applied to the throat may be used in addition to the inhalations.

SPASMODIC CROUP.

This is what is ordinarily known as "croup." It occurs in children and is due exactly to the same factors which cause laryngitis in an adult. Some children have croup with every cold.

During the day the mother notices that the child is hoarse and a little feverish. There is apt to be a sharp, ringing cough.

Symptoms.—The attacks occur at night, the child waking suddenly and becoming alarmed because breathing is difficult. The fear, together with the difficult respiration, makes the spasm worse and consequently aggravates the condition. There is usually a ringing cough and inspiration is accompanied by a sharp, crowing sound. The child's face may be blue in color and the whole condition most alarming.

Treatment.—Spasmodic croup, while serious, never ends fatally, the attack always subsiding before morning. The attack can often be prevented if a cathartic is given in the evening when the first symptoms of a croupy cough are noticed. The child's fears should be quieted and the bed placed in a room where the air is warm and moist.

A "croup tent" is an excellent means of preventing or treating croup. It is made by draping a sheet over the head of the bed in such a manner that the child is covered with a small improvised tent. An alcohol stove and a small kettle are so arranged on the floor that the steam from the boiling water passes into the tent, the child breathing the vapor-laden air. A teaspoonful of compound tincture of benzoin may be added to the water. The child should not be left alone, for such an improvised tent is easily disarranged and may take fire from the alcohol lamp.

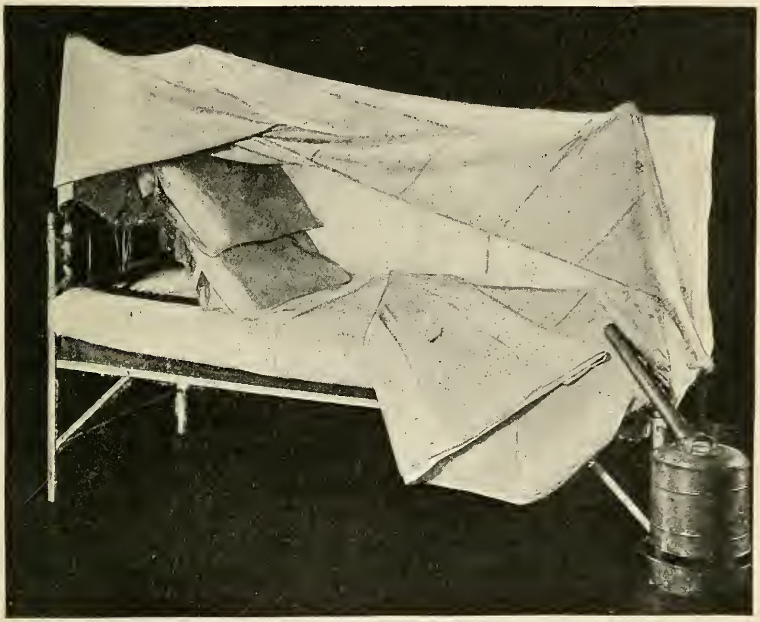


Fig. 143.—Croup tent improvised by the use of two sheets and four broomsticks lashed to the corners of a child's cot. The steam kettle is shown at the right-hand corner of the picture. (Hare.)

If the attack has already begun the child should be given 15 drops of syrup of ipecac every fifteen minutes until vomiting occurs. In addition to the vapor inhalations, warm compresses may be applied to the neck and chest. These compresses are similar to those described under Sore Throat, except that they are wrung out of hot water.

DIPHTHERITIC CROUP.

This is due to true diphtheria, with membrane formation on the vocal cords. The symptoms are similar to those of spasmodic croup, except for the fact that the inspiratory stridor, or crow, is constant and does not occur in attacks. A child in such a condition should receive antitoxin and other treatment for diphtheria without delay.

COUGH.

This may occur as part of an infectious cold or it may be due to irritation caused by smoke, dust, or any of the numerous forms of irritating gases. A severe, persistent cough may be a symptom of bronchitis, tuberculosis, or pneumonia.

Treatment.—The irritation may be often allayed by 5 or 10 drops of syrup of ipecac in a little water. A favorite household remedy consists of equal parts of glycerin, whisky, and rock candy (or sugar), given in teaspoonful doses every hour. Steam inhalations with compound tincture of benzoin, as outlined above for laryngitis, or a cold compress applied to the neck, may be tried. When the cough is persistent, or when it is associated with fever, the advice of a physician should be obtained.

SHORTNESS OF BREATH.

After exercise a certain degree of shortness of breath is normal, but when the symptom persists for a half-hour or longer, or is out of proportion to the degree of exertion, it may indicate heart trouble.

Treatment.—The treatment consists of rest and stimulation. Patients with weak hearts are usually very uncomfortable when obliged to lie flat in bed, consequently they should be allowed to sit up in a chair in the position which they find the most comfortable. Stimulation with aromatic spirits of ammonia or strong coffee should be given and a physician secured at once.

INDIGESTION.

By indigestion we usually mean a sense of fulness and indefinite abdominal distress after eating. This may occur after a large meal or after eating only a small amount of some particularly indigestible food. Some persons cannot eat a single mouthful of raw apple without suffering from indigestion.

Indigestion is only a symptom and may indicate gastric ulcer, chronic gastritis, hyperacidity, or any one of several other conditions.

Treatment.—The distress may sometimes be relieved by a cup of hot water, a glassful of Vichy, a little bicarbonate of soda dissolved in water, or by several soda-mint tablets.

Drugs which are warming and slightly stimulating frequently relieve the gastric distress. The most familiar of these drugs are essence of peppermint, ginger tea, brandy or whisky, or any other similar form of medication. Rhubarb and soda mixture, which can be procured in any drug store, may be given in teaspoonful doses every half-hour for several doses.

If the distress is severe the patient may be encouraged to vomit. The best way to accomplish this is to give a glass or two of lukewarm water and then to cause vomiting by tickling the back of the throat with the index finger.

NAUSEA AND VOMITING.

This condition may result from overeating, from the eating of indigestible food, or from the taking of some form of poison (often ptomains). In addition, it occurs at the beginning of many infectious diseases (especially in children) and is often associated with diseases of the stomach and intestines.

Treatment.—For the cases which result from simple causes, such as overloading of the stomach, it is best to wash out the stomach as outlined above. If the vomiting persists after the stomach is emptied, it is apparently due to some cause, or causes, more deeply seated.

In the absence of a physician, efforts should be directed toward those remedies which tend to lessen nausea. In some cases it will cease if absolutely nothing is given by mouth for several hours. In other cases, teaspoonful doses of carbonated water or champagne, given at fifteen-minute intervals, will diminish the nausea and lessen the vomiting. In still other cases a soda-mint tablet or a little baking soda dissolved in water will relieve the nausea without other treatment.

A hot-water bottle or a mustard plaster placed over the pit of the stomach is an additional measure which may prove efficacious.

COLIC.

This is the name given to abdominal cramps. The cramps may occur as a result of intestinal irritation by indigestible foods or poisons, or it may occur as a result of disease, such as appendicitis, gall-stones, or strangulated hernia.

The colic of appendicitis begins in the center of the abdomen like any other colic, but after a few hours becomes localized in the lower part of the right side of the abdomen. In ordinary "green-apple" colic the pain is more general in character, being most severe in the region of the navel.

Treatment.—The treatment is similar to the treatment of indigestion. If it is reasonably certain that the cramps are due to improper food or poisons, a cathartic should be given at once. Castor oil or salts, because they work quickly, are preferable to slower acting cathartics. In many cases a soapsuds enema which empties the lower bowel will relieve the cramps. In addition, a hot-water bag, or other form of heat, may be applied to the abdomen. If there is fever or shock the condition is more serious in character and requires the attention of a physician at once.

APPENDICITIS.

The symptoms are very similar to those just given, but the typical symptom of appendicitis is tenderness on deep pressure in the lower half of the right side of the abdomen. This local tenderness sometimes occurs alone, but it is almost always associated with fever, and often with nausea and vomiting and generalized abdominal colic.

Treatment.—If appendicitis is suspected the patient should be kept flat in bed, nothing but water being given by mouth, and an ice-bag being placed over the area of tenderness. Cathartics are never prescribed, but there is no harm in giving an enema, which may relieve the colic. If there are any symptoms which suggest appendicitis the early services of a physician are required.

DIARRHEA.

We have already seen that diarrhea is associated with ptomain poisoning, but it may also be caused by other forms of poisoning or by the ingestion of indigestible food, such as green apples.

It may be looked upon as an attempt on the part of the intestine to rid itself of substances which are injurious. Consequently, we should always start any plan of treatment by using something which will thoroughly cleanse the bowels.

Treatment.—Castor oil is the best remedy for diarrhea. In addition to causing an active and early movement of the bowels the oil is soothing to the irritated intestine. If castor oil cannot be taken a Seidlitz powder or dose of Epsom salts may be given. If these are vomited, as sometimes happens, calomel may be given in $\frac{1}{10}$-grain doses, every fifteen minutes for ten doses. The calomel should be followed six to twelve hours later by a Seidlitz powder or a dose of Epsom salts.

After the cathartic has acted, small doses of brandy, or bismuth[1] may be given. Paregoric in 10-drop doses every hour for five or six doses may be given to an adult, but should never be given to young children. Never attempt to check diarrhea until the intestines have been cleaned out by suitable catharsis.

After an attack of diarrhea the diet should be absolutely

[1] Bismuth is given in the form of bismuth subnitrate, 10 grains in a little water every two or three hours.

non-irritating. Broths, tea, coffee, and fruit juices contain no irritating residue, and may be given freely. After the diarrhea has ceased, boiled milk can be given, and later bread, cooked cereal, custard, and other simple foods.

The commercial diarrhea and "cholera" cures usually contain opium, and are seldom free from danger. They should never be given to children.

HEMORRHOIDS.

This condition, commonly called "piles," may require emergency treatment either because of severe pain or because of hemorrhage.

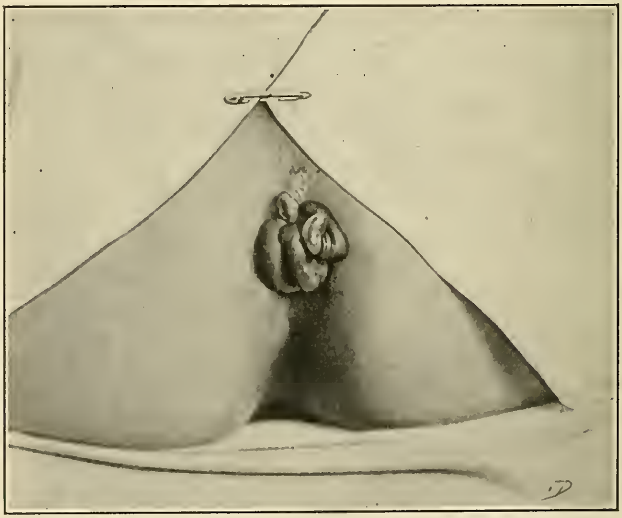


FIG. 144.—Showing protruding internal piles. (Lynch.)

Piles are small dilated veins in the region of the anus. They may be internal, that is, inside the bowel, or external, near the margin of the anus. They may become inflamed and very painful, or they may be ruptured, causing more or less profuse hemorrhage. When not inflamed they cause little or no pain.

Treatment.—Internal piles should be at once reduced. That is, they should be pushed back into the bowel with the finger previously well greased with vaselin.

The pain from either internal or external piles may be relieved by an enema or by cold compresses. During the period of severe pain it is well to give a small enema before the bowels move so that they will move easily and there will be no injury during the movement.

Although hemorrhage from piles is common, serious hemorrhage is extremely rare. If there has been profuse hemorrhage the patient should rest quietly in bed and, if necessary, a few ounces of cold water may be injected into the rectum. If an external pile is bleeding a dry compress may be applied directly to the bleeding-point.

If piles are present, hemorrhage and pain may be prevented by careful attention to the following three rules:

1. Never strain in attempting to make the bowels move.
2. If the hemorrhoids are forced down through the anus always press them back at once.
3. Never allow the bowels to become constipated.

PAINFUL JOINTS.

The joints may be painful from sprains, from injury, or from disease. Acute, or chronic, infectious arthritis is the name given to an inflammation of the joints which results from the entrance of infectious material into the joint. The poison may be derived from a focus in other parts of the body. Purulent inflammation of the tonsils or teeth may serve as a point of entrance for infection of the joints. Acute articular rheumatism is one of the commonest types of acute infection of the joint.

Treatment.—The treatment depends largely upon the cause. For the infectious types medical treatment is required. For the traumatic cases and for mild cases of ill-defined origin the pain may be temporarily relieved by the use of heat, either in the form of dry heat or by the application of hot compresses, combined with rest of the affected joint. If an ointment of oil of wintergreen can be secured it may be applied over the painful area and the joint covered with a thick layer of cotton, which is then firmly bandaged in place. In transportation of patients with painful or inflamed joints a suitable splint is applied so that the weight of the limb is supported.

PAINFUL MUSCLES.

One of the commonest causes of pain referred to the muscles is "muscle strain," which has already been discussed. In addition, unusual muscular exertion may result in either general or local "soreness." Neuritis may cause a severe pain which the patient often refers to the definite group of muscles.

Treatment.—Massage either with or without the use of a liniment will often relieve the pain in the muscles. Athletes make use of this in the rubbing which they receive before and after any unusual exercise. The form of liniment is not important. Spirits of camphor, chloroform liniment, capsicum ointment, and many others may be used. The main requirement is to secure an increased circulation of the part, with a certain amount of counter-irritation.

When the pain is very severe, local heat, preferably dry heat, may be used. I require patients suffering from muscular pains to sit in front of an open fire and toast the painful muscles for thirty minutes or more twice daily. Heat in the form of hot-water bags, or electric pads, or any other available form of heat will usually give relief.

WARTS AND MOLES.

Warts, moles, and other small tumors should be removed surgically. While it is sometimes possible to remove these tumors by the use of caustics, such measures may cause the growth to become cancerous. For this reason it is never advisable to attempt their removal except under the advice of a physician.

IVY POISONING.

There are several varieties of plants which may cause skin-poisoning. They belong to the oak or sumac family, and are spoken of as poison ivy or poison oak.

From the stand-point of treatment the differentiation of the several varieties is not important, for the skin symptoms are practically the same.

These plants are extremely poisonous, so that when touched they cause severe irritation of the skin. A peculiar

FIG. 145.—Rhus toxicodendron: leaf half natural size. This is the common form of poison ivy. (Culbreth.)

circumstance, however, is that some persons are apparently immune to the poison, being able to handle the plants with impunity. On the other hand, some persons are especially susceptible, even the slightest touch resulting in a severe reaction.

The poison may be carried from one part of the body to another. That is, if it is on the hands it may be carried to the face or any other part of the body. Very rarely one person may transmit it by direct touch to the skin of another.

It is important to recognize and to avoid poison ivy whenever in the woods. Do not conclude that because you have touched the plant once without injury you are immune.

The disease becomes evident by scattered areas of redness, usually beginning on the hands and face, but soon being spread to other parts by scratching. The reddened areas become acutely inflamed and swollen, numerous small blisters form, and there is intense itching. This condition usually begins about two or three days after exposure, increases for two or three days, and then gradually subsides.

Fig. 146.—Showing the formation of blebs on the wrist, the result of ivy poisoning. (Ormsby.)

Treatment.—The patient usually requires treatment to relieve the itching. Bicarbonate of soda solution (2 per cent.), carbolized vaselin (5 per cent.), and lime-water may all be tried. In the use of soda solution or lime-water, cloths are wet and placed over the inflamed area, being kept constantly wet with the solution used. Carbolized vaselin is smeared upon the eruption once or twice daily.

During the later stages zinc oxide ointment may be spread over the entire surface.

Recovery is usually complete in about ten days. In a few cases the blisters may become infected, in which case a wet boric acid dressing should be applied.

CHAPTER XIII.

TRANSPORTATION.

In the treatment of an injured person it is usually necessary to remove him from the spot where the injury was received to a location more suitable for treatment. In cities this is usually accomplished by the public ambulances, but in the country this duty falls on the man trained in first aid.

As the conveniences of civilization are left farther and farther behind a clear understanding of the best methods of transportation becomes of greater and greater importance. In camp life and on the battlefield the problem of the care of the sick and wounded is largely one of transportation. There are so few conveniences for the care of the injured on the battle ground and deep in the forests that all except the severely injured must be carried to a point where conveniences for treatment are obtainable.

And it is more than a matter of simple transportation. The carrying must be done intelligently, with due regard to the injuries of the patient and the distance to be traversed. A broken bone may be thrust through the skin, resulting in a compound fracture, or bleeding from a wound may be increased by unskilled handling of the injured person. Transportation which causes an increased amount of pain, and which wastes the patient's strength, tends, as we have seen, to increase the amount of shock.

Before attempting any sort of transportation a careful examination should be made to determine the nature of the injury. First aid should be given and the necessary splints and dressings applied. If the bleeding from the wound is profuse it is much wiser not to attempt transportation, except for very short distances, until the hemorrhage has practically entirely ceased.

The character of the transportation depends largely upon the nature of the complaint and upon the means of transportation at hand. For long distances, wheel transportation, wagon, or automobile, is much preferred. For short distances transportation by stretcher or litter, when available, is the most desirable method.

LITTER TRANSPORTATION.

A litter, or stretcher, is commonly made of canvas stretched between two poles, the ends of the poles serving as handles. There are different varieties of litters in use, each of which may have some particular advantages for the special use for which it is intended. For field work the United States Army litter is one of the best.

The regulation hand litter consists of a canvas bed 6 feet long and 22 inches wide, made fast to two poles $7\frac{1}{2}$ feet long, and stretched by two jointed braces. The ends of the poles form the handles, 9 inches long, by which the litter is carried. The fixed iron legs are stirrup-shaped, 4 inches high and $1\frac{3}{4}$ inches wide. On the left front and rear handles a half-round iron ring is fixed, $4\frac{1}{2}$ inches from the end; between this and the canvas plays a movable ring of the sling.

One pair of slings is permanently attached to each litter. They are made of khaki-colored webbing, $2\frac{1}{2}$ inches wide, with a leather lined loop at each end and a slide to regulate the length. One loop of the sling passes through the metal swivel, itself attached to the movable ring of the handle.[1]

The advantages of this litter are that it can be folded into small space when not in use; it is held slightly raised from the ground by the fixed iron legs so that it serves as a temporary bed; and, because of the carrying straps, it is well adapted for carrying patients long distances.

Its chief disadvantage is that it is unnecessarily heavy for the ordinary emergency work. The methods of improvising stretchers will be referred to later.

[1] Drill Regulations and Service Manual for Sanitary Troops, United States Army, 1914.

Litter Drills.—It is not absolutely necessary that a thorough knowledge of first aid should include a knowledge of litter drill, but in all field work, in factories, in schools, and in such organizations as the Boy Scouts, a knowledge of a definite drill will enable a given group of men to accomplish much better results in less time than it is possible without some form of drill.

The following drill is modified from the *Regulations of the Sanitary Troops, United States Army:*

In the military service, to secure uniformity and precision in the execution of all movements, commands are invariably given in two parts—the first called the *preparatory command* and the second the *command of execution.* Except in very few instances no movement is made at the "preparatory command" but all "prepare themselves" at this command to complete the movement in unison at the "command of execution."

The litter squad consists of two men—No. 2, counting from the right, is the squad leader unless a special squad leader is designated. In all cases, even with a special squad leader or captain, No. 2 or the rear litter bearer, should watch the movements of the front bearer and time his own by them so as to insure ease and steadiness of action. The bearers should keep the litter horizontal, notwithstanding any unevenness of the ground.

As nearly as possible, complementary movements are paired. The commands of execution are given in "SMALL CAPITALS."

The squads having "Fallen In" and their position numbers designated the command is given:

Procure litter. MARCH. At the command MARCH the No. 2 or 2's[1] proceed to the litter or litters and each man puts one on his shoulder and returns to his position in line.

[1] When more than one squad is assembled it is customary to execute this movement as follows: Commands: Procure litter. Right (left) face. MARCH. At litter, each No. 2 steps one pace to the front; at face they face as required, and at MARCH proceed in column of files by the nearest route to the litters. They each take one, place it on right shoulder at an angle of 45 degrees, canvas down, and return in reverse order and resume places in rank.

Being in line, litters at the shoulder:

Carry. LITTER.

At LITTER, each No. 2 brings his litter to the vertical position, drops the upper handles forward and downward until the litter is in a horizontal position, canvas up, and grasps the outside handle with his right hand; meanwhile No. 1 steps directly to the front until he is opposite the front handles when he grasps his outside handle with his left hand.

Being at the carry:

Shoulder. LITTER.

At LITTER, No. 2 advances and plants the left foot one pace forward, reaches forward with the left hand and grasps the litter near its center, grasps the right stirrup with the right hand, and brings the litter to the vertical position and then to the shoulder, at the same time replacing the left foot by the right; meanwhile No. 1 steps backward and aligns himself on No. 2.

Being at the carry:

Ground. LITTER.

At LITTER, the bearers stoop and lower the litter to the ground, canvas up, and stand erect, facing the front.

Being at the ground:

Carry. LITTER.

At LITTER, the bearers stoop, grasp the handles and raise the litter from the ground to the carry.

The above movements are only executed with the closed litter.

Being at the carry, litter closed.

Open. LITTER.

At LITTER, both bearers face the litter and slip the free loop of each sling upon the ring handle, the bight embracing the opposite handle; they then grasp the left handles with their left hands and drop the other handles, the litter being thus suspended by the left pole, canvas to the right. They then fully extend the braces, lower the litter to the ground, canvas up, and stand between the handles, facing the front.

The litter being open and lowered:

Close. LITTER.

At Litter, Nos. 1 and 2, respectively, step outside the right front and left rear handles, and face inward; they stoop and with their hands raise the litter by the handle of the left pole; they then fold the braces, and bringing the lower pole against the upper, face to the front and support the litter at the carry.

To bring the squad into line, the litter being at the ground or the open, with the men at litter posts:

Form. Rank.

At Rank, No. 1 advances one pace and No. 2 aligns himself on No. 1. Original positions at the litter are resumed at the command "litter—posts," all executing an about face, proceeding to their posts at the litter, and facing to the front together.

This movement permits the marching of the squad, without litter, to any desired point.

Posts at the litter may at any time be recovered by the commands:

Litter. Posts.

If at the ground the numbers take posts, No. 1 on the right of the front handles, No. 2 on the left of the rear handles and close to them, facing the front. If at the open, Nos. 1 and 2 take posts between the front and rear handles, respectively, facing the front.

The foot, or front, of a grounded or opened (unloaded) litter is the end farthest from the advancing squad, unless otherwise designated. The foot of a loaded litter is always the end corresponding to the feet of the patient.

In case a permanently (fixed) open litter only is available the closed litter movements must be dispensed with. The commands for the squad with an open litter are always the same, whether the litter is empty or loaded; in other words, always treat the open litter as if it were loaded.

As a rule the patient should be carried on the litter feet foremost, but in going uphill his head should be in front. In case of fracture of the lower extremities he is carried uphill feet foremost to prevent the weight of the body from pressing on the injured part.

To maneuver properly with the open litter, litter intervals must be taken. Of course, it is obvious that this is necessary only when more than one litter squad is being drilled. The movement is as follows:

Being in line, litters at the shoulder:

Take litter interval. To the right (left). MARCH.

Detachment. HALT.

At the command MARCH Nos. 2 bring their litters to the vertical position, all face to the right (left), and the leading squad steps off, Nos. 1 and 2 of each squad preserving facing distance with relation to each other. When the leading squad has advanced three paces the squad next in order steps off following it in column, and so on, until all the squads are marching in the indicated direction, three paces apart.

At HALT, all halt and face to the original front, the litters being returned to the shoulder position.

This formation is designated "line of litters" regardless of the position of the litter.

To assemble, being in line of litters, at the shoulder.

Assemble to the right (left). MARCH.

At MARCH, the squad on the flank indicated stands fast in position. The other squads face to the right (left), close in as commanded and face to the front.

Being at the open:

Prepare to lift. LIFT.

At the first command the bearers without facing about, stoop, slip the slings off the handles and place them over their shoulders; they then replace the free loop on its handle, adjust the length of the slings if necessary, and firmly grasp the handles of the litter; at LIFT they slowly rise erect.

Being at the lift:

Lower. LITTER.

At LITTER, the bearers slowly lower the litter to the ground. Each number then seizes the free loop and bight of his sling, removes the sling from his shoulders, and places the loop on the ring handle, the bight embracing the opposite handle.

Being at the lift:

Forward. MARCH.

The bearers step off, No. 1 with the *left* and No. 2 with the *right* foot, taking short sliding steps of about 20 inches, to avoid jolting and to secure a uniform motion to the litter. The cadence is at about 100 steps to the minute.

The marching movements with the litter are very similar to those of the squad in the *Army Manual* except that command "litter" replaces that of "fours" and ordinarily a litter squad turns or "wheels" on its own ground.

The Loaded Litter.—In moving the patient either with or without the litter, every movement should be made deliberately and as gently as possible, having special care not to jar the injured part. The command *steady* will be used to prevent undue haste or other irregular movements. The loaded litter should never be lifted or lowered without orders. The handles of the litter should be held in the hands

FIG. 147.—Method of lifting a patient on or off the litter.

at arm's length and supported by the slings. Only under most exceptional conditions should the handles be supported on the shoulders.

Under exceptional circumstances, as in ascending or descending stairs, when the patient is very heavy, the ground difficult, or an obstacle over 3 feet high has to be surmounted, it may be necessary to use additional bearers. In this case the additional man or squad is aligned on the left, and, when necessary, assigned to any position designated by the squad leader.

To load the litter: the litter being at the open: two ways designated:

1. Right (left) side. POSTS.

At the command POSTS the bearers go to the right (left) side of patient and take positions, No. 1 at right (left) thigh and No. 2 at right (left) shoulder, facing the patient.

Prepare to lift. LIFT.

At the first command the bearers kneel on the knee nearest the patient's feet, No. 1 passes one arm under the patient's hips and the other beneath the knees; No. 2 passes one arm under the shoulders to the farther armpit, and the other arm beneath the small of the back.

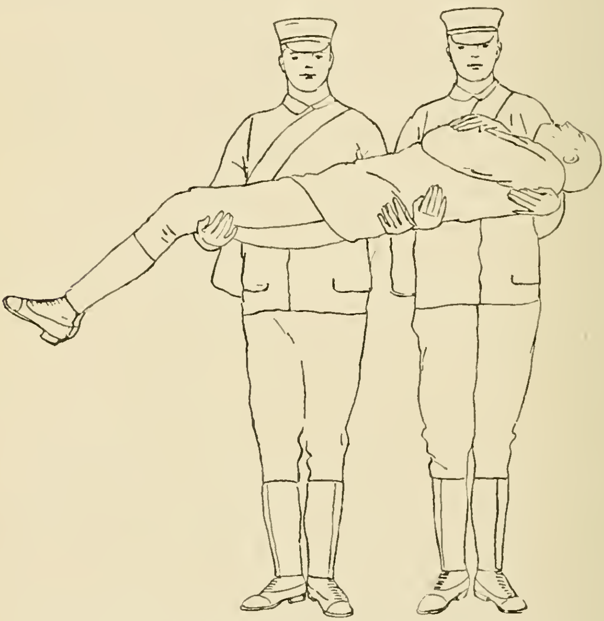


FIG. 148.—Carrying a litter patient in the recumbent position.

At LIFT they lift together, slowly and carefully, raising the patient upon their knees, then readjusting their hold, rise to their feet and carry the patient by the shortest route to the side of the litter, where the squad is halted.

Lower. PATIENT.

At PATIENT, the bearers kneel and place the patient on their knees; they stoop forward and lower him gently on the litter; they then rise and at once resume their positions at *litter posts*, without command.

Should it be necessary in emergencies to use three bearers, this may be done with similar commands, by having the third bearer placed at the patient in such a way that he may support the knees and legs.

2. Hips. Posts.

At Posts, No. 1 proceeds to the patient's right hip and No. 2 to the left hip, facing the patient.

Prepare to lift. Lift.

At the first command the bearers kneel on the knee nearest the patient's feet; they then raise him to a sitting position and pass each one hand and arm around his back, while the other hands are passed under the thighs, grasping hands. The patient, if able, clasps his arms around the bearers' necks. At Lift, they lift the patient both rising together and carry him to the center of the side of the litter where the squad is halted.

Lower. Patient.

At Patient the bearers stoop and lower the patient upon the litter to a sitting position, the patient releasing his hold around the bearers' necks. No. 2 then passes his left hand across the patient's chest to the opposite armpit and grasps the patient. No. 1 releases his hold at the right of the patient, steps astride of the patient's lower extremities and grasps the patient's right and left thighs just above the knees with his left and right hands, respectively. Both bearers then turn and lower the patient upon the litter, head toward No. 2 and take their positions at litter posts without commands.

To unload, posts are taken and the patient lifted in the same manner and by the same commands. At *Hips*—Posts, the bearers take their posts at the sides of the litter and at *prepare to lift* they lift the patient to a sitting position on the side of the litter by reversing the movements heretofore described and then take the positions of *prepare to lift*.

The bearers move backward if at "side, Posts" and forward if at "hips, Posts," until clear of the litter, when they halt and lower the patient.

The drill should be made as nearly as possible like actual first-aid work. For this purpose a diagnosis tag having been attached to the clothing of the "injured person" indicating the site and character of the injury to be dressed before loading, the necessary first-aid dressing should be applied and the "patient" transported as directed.

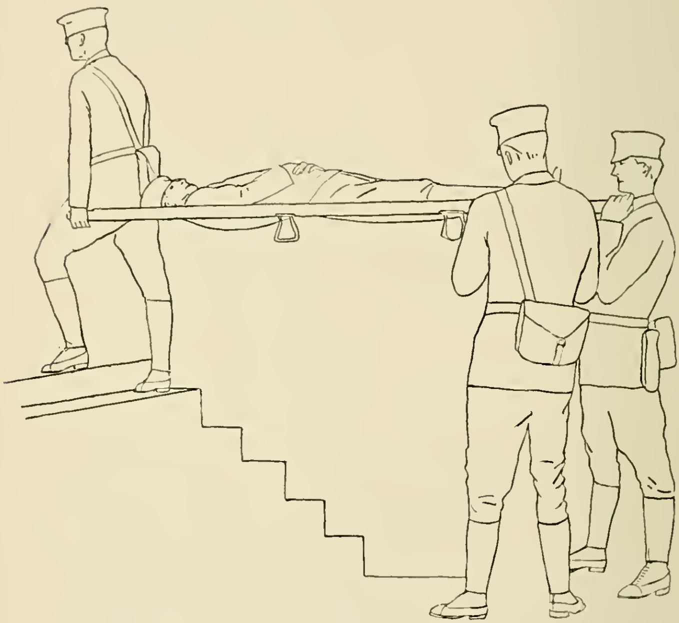


FIG. 149.—Method of carrying a litter upstairs. Note that the litter is carried in the horizontal position.

To Pass Obstacles.—If the ground is very uneven or the distance far, the bearer squads should always consist of three or four men, preferably four.

To carry a loaded litter upstairs, the patient should be carried head first. The leading bearer (or bearers) carries his end of the stretcher low and the following bearers carry their end high so that the litter remains horizontal. In carrying downstairs the process is reversed except that the patient travels feet first. The leading bearers hold their end of the stretcher high while the other end is lowered.

To cross a fence or other low obstacle only two bearers are necessary. The litter is placed on the ground with the head next to the fence and the bearers take their places

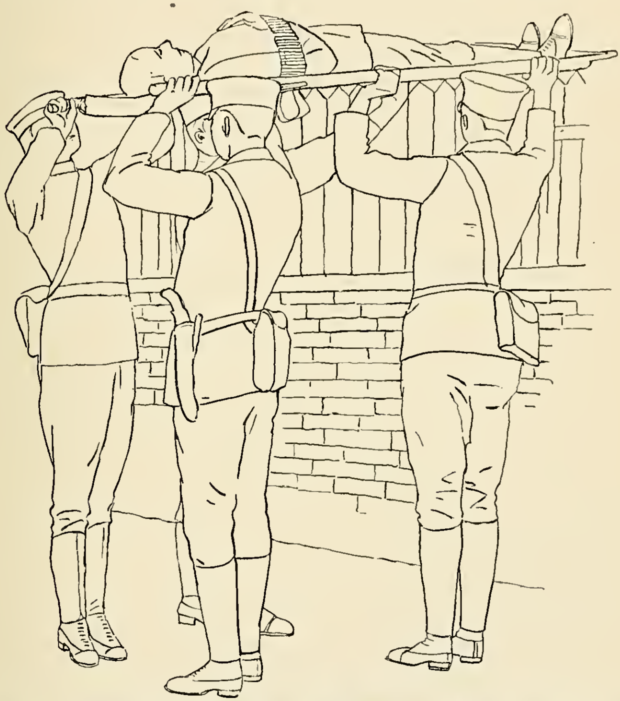


FIG. 150.—Method of crossing a high obstacle. When the front end of the litter rests upon the fence, two bearers cross the fence and work from the other side.

at the sides of the litter, lifting it until the head of the litter can be rested on the fence. When the front stirrups have cleared the fence the bearers work back to the foot and one man takes his place at the foot, the other climbing across the fence and taking the head. The litter is now lifted until the foot rests on the fence and the second bearer crosses the fence. He takes his place at the front with the other bearer and they work their way until they are one on each side near the center. The litter is now lifted down and placed on the ground and two bearers take their respective places at the ends of the litter.

To cross a high fence four bearers are necessary. Each man takes his place facing the litter, grasps a handle with both hands and raises it to the top of the fence. It is then moved until the leading stirrups have cleared the fence and allowed to rest there. The two front bearers then cross the fence and taking their places advance the litter until the rear handles rest on the obstacle. The rear bearers now cross the fence and take their places, when the litter is lowered. A litter may be taken in or out of a window on the ground floor in the same manner.

To place a litter in an ambulance two litter bearers take their places on the opposite sides of the litter which is on the ground in the rear of the ambulance with the patient's head toward the ambulance. At the command "lift" the bearers lift the litter by the sides and advance toward the ambulance until the front stirrups rest on the floor of the ambulance. The litter may be pushed along the floor of the ambulance. Always be sure to make the tailboard fast after the patient is placed in the ambulance. When going up a steep hill it is very easy for the stretcher and the patient to slip out unless the tailboard is firmly fixed.

To cross a narrow trench the stretcher is placed with the head toward the trench and the bearers, taking posts at the sides, move it carefully to the edge of the trench. They then straddle the trench and, lifting the litter slightly from the ground, advance it until it bridges the trench. The advance is continued until the litter is entirely on the other side.

In wide trenches or small streams some sort of bridge must be improvised. Shallow streams, of course, may be forded.

To Improvise a Litter.—There are many ways of improvising a litter. A small light cot makes one of the most satisfactory litters. Benches, window shutters, doors, ladders, etc., all properly padded, may be used. Care should be taken that the padding should be firmly attached to the improvised litter or the patient will easily slip off.

A litter may be made by cutting holes in the bottoms of two or three sacks and slipping two poles through the bags. Cross-pieces should be tied or nailed between the ends of the poles in order to keep them apart. Canvas, carpet, or other heavy cloth may be tacked to two poles and used in the same way.

The Coat Litter.—The coat litter is a great favorite in first-aid teaching. Two coats are removed and buttoned down the front and the sleeves turned inside out. If poles are passed through the sleeves the coats form a fairly good support. The main disadvantages are that the buttons break off and the coats are apt to tear when a patient is carried.

The Blanket and Rifle Stretcher.—The blanket and rifle stretcher, commonly used by soldiers, is an easily improvised stretcher. The blanket is spread out on the ground and an unloaded rifle placed in the center over which the blanket is folded, forming a rectangle. In the center of this rectangle a second rifle is placed parallel to the first and the free edges of the blanket folded over this toward the first rifle. Poles may be used instead of rifles. This form of stretcher requires four men to carry it. It is not very firm because the blankets easily slip loose.

By folding the blanket once from side to side and placing a rifle crossways at the center so that the butt and muzzle project beyond the edges, folding the blanket over this and placing the second rifle parallel to the first and again folding the double blanket, exactly the same litter is formed as described above, except that it is very short. Patient may be carried in this using it as a seat.

The Chair Litter.—For emergencies in and about dwellings an ordinary chair of firm construction makes a most satisfactory litter. The patient is seated in the chair which is tilted backward so that the patient lies in a nearly horizontal position. Two bearers carry the chair, one holding the back of the chair and the other, walking backward, holds the chair by the two front legs.

TRANSPORTATION WITHOUT LITTER.

A single bearer may carry a patient in his arms or on his back.

To Lift a Helpless Patient.—The patient is placed upon his face and the bearer stands astride, the back facing the head. With the hands under the armpits the patient is lifted to

Fig. 151.—One method by which a single bearer may carry a patient.

the knees; then clasping the hands over the abdomen the patient is lifted to his feet; the bearer then with his left hand seizes the patient's left wrist and draws the left arm about his own neck, holding the patient supported against his right side with his right arm about the waist. The bearer then quickly places the left arm beneath the patient's thighs and lifts him up. If the patient can help himself a little he can assist by holding firmly to the bearer's shoulders with his left arm.

To Carry Across the Back.—The patient is lifted erect as described above. The bearer then seizes the right wrist of the patient and draws the arm over his head to his left shoulder where it is held with his left hand, then shifting himself in front, he stoops and clasps the right thigh with his right arm passed between the patient's legs, reaching his right hand upward to grasp the right wrist of the patient. The bearer then grasps the patient's left hand and holds it to his side; he then rises with the weight of the patient borne on his shoulders.

If the patient can help himself he may be carried astride the back. He is lifted as described above and the bearer shifts in front, stoops and grasping one thigh under each arm lifts the patient well up upon his back, the patient meanwhile holding the bearer firmly with arms clasped about his neck.

Two bearers may carry an injured patient by the use of what is known to children as the "ladies' chair." In its formation, each of the two grasps his right wrist with his left hand, back uppermost and then each grasps the other's left wrist with his right hand. The patient sits on this and places his arms about the necks of the bearers for support.

Two bearers may carry a patient as follows: One grasps him beneath his armpits and the other standing between his legs grasps the thighs just above the knee. Both lift together.

THE TRAVOIS.

The travois is a vehicle for the transportation of the sick when wheel transportation is impracticable. It consists of two long poles, the larger end of each being attached to the sides of a horse like shafts, the smaller ends dragging, one of which is projecting 8 to 10 inches behind the other. Behind the horse crossbars are set to hold the poles apart, and a canvas bed arranged in which the patient rests. An attendant must walk behind to lift the end of the travois while traversing uneven ground or going up hill. As may be supposed, this vehicle makes pretty rough travelling for an injured man.

If not too badly injured a wounded man may be carried on horseback, preferably riding double with an attendant who rides behind and furnishes necessary support.

WHEEL TRANSPORTATION.

Wheel transportation includes every method of transportation on wheels from a child's express wagon to the latest thing in hospital trains. Wherever roads are at all passable, make every possible use of wheel transportation. For long distances it is almost the only form of transportation which can be used. The transportation by litter should be exchanged for wheel transportation whenever possible.

In war, where many wounded must be moved, long transportation by litter soon exhausts all the litter bearers and makes the removal of the wounded very difficult. It is hard work to carry a loaded litter. Try it yourself some time and notice the fatigue after two or three hundred yards.

If called upon to move a wounded man a long distance, secure the best available means of transportation but don't despise the smallest cart, if nothing better is at hand.

THE AMBULANCE.

The ambulance is a specially constructed vehicle for the transportation of the sick and injured. It may be horse-drawn or driven by motor. In the European war the motor-driven ambulance has largely supplanted the older horse ambulances. The army ambulances are arranged to carry four patients on litters, two above and two on the floor of the vehicle. On the sides are two hinged seats, which, when not in use, may be folded against the sides. These seats may be used for patients who can sit up so that the ambulance will carry eight patients sitting, or four recumbent. The body of the motor ambulance is arranged in the same way as a horse-drawn ambulance. Beneath the seat are carried dressings, splints and other supplies.

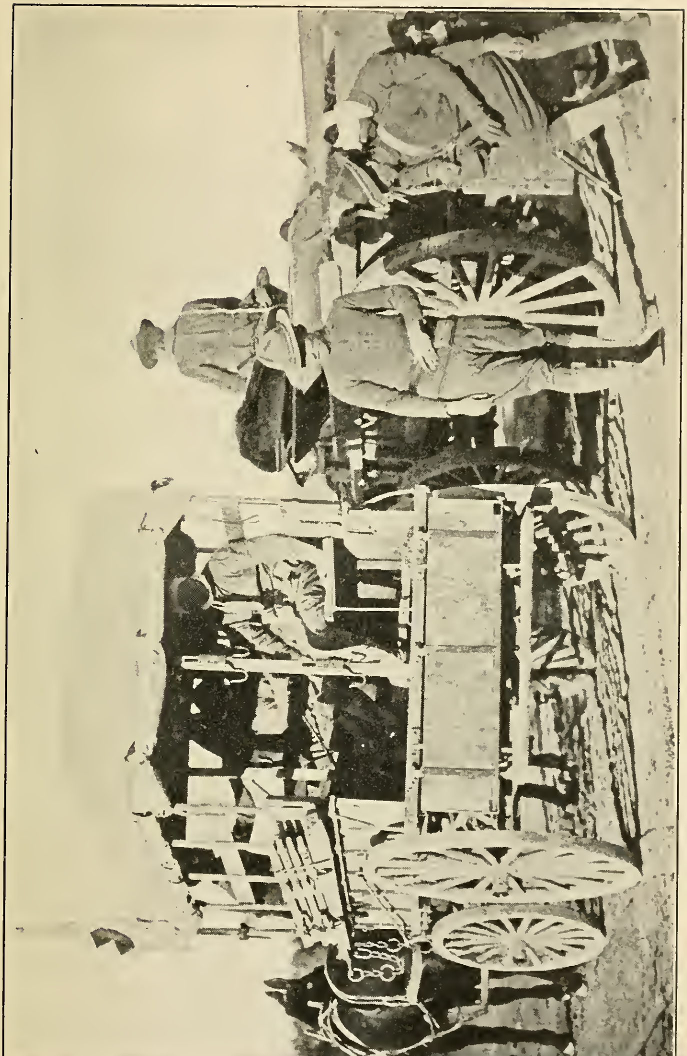


FIG. 152.—Army ambulance, in use upon the Mexican border, being used to carry patients who are able to sit up. The folded litters may be seen attached to the side of the ambulance. (Copyright by Underwood & Underwood.)

In cities the ordinary hospital ambulance is seldom equipped to carry more than two patients.

It is often necessary to improvise an ambulance. For a litter patient the ordinary touring car is never satisfactory. Patients who are able to sit up may conveniently be transported in touring cars but recumbent patients require a wagon or an automobile with a body large enough to hold the litter. In the country, where litters are not available, I have been accumstomed to remove the legs from a narrow cot and place this in a wagon about the size of the ordinary grocery wagon. The springs of the cot form a much more satisfactory bed than the hard wagon body. In addition the patient can be first placed on the cot, which forms an improvised litter, and can thus be easily moved into the vehicle.

The movement of a recumbent patient by train may be accompanied by many difficulties. The ordinary Pullman car is so arranged that it is impossible to carry a litter in through the narrow hallway. A few have large windows through which a litter may be passed, but in most cases the windows are much too narrow. For short distances I have found it more convenient to transport a litter patient on a cot in the baggage car than to attempt to enter the Pullman or day coach. For long distances the added conveniences of the Pullman are of so much advantage that if it is impossible to pass the litter in through the window it is usually justifiable for two bearers to carry the patient in through the narrow hallway. The leading bearer, who walks backward, holds the patient beneath the armpits while the second supports the legs, his hands clasped beneath the patient's knees.

In the army, special hospital trains are fully equipped for both major and minor surgery. They have large side doors for the admission of patients. In case of a railway accident where many patients are injured it is much better to send freight and baggage cars to bring back the wounded, than the ordinary passenger cars or Pullmans.

In major emergencies it is sometimes necessary to improvise hospital cars. For this purpose the ordinary freight car serves better than either passenger coaches or Pullman cars. The stretchers are easily passed in through the side doors and the patients placed on mattresses on the car floors. A special car fitting has been designed which is used in the United States Army and permits the carrying of large

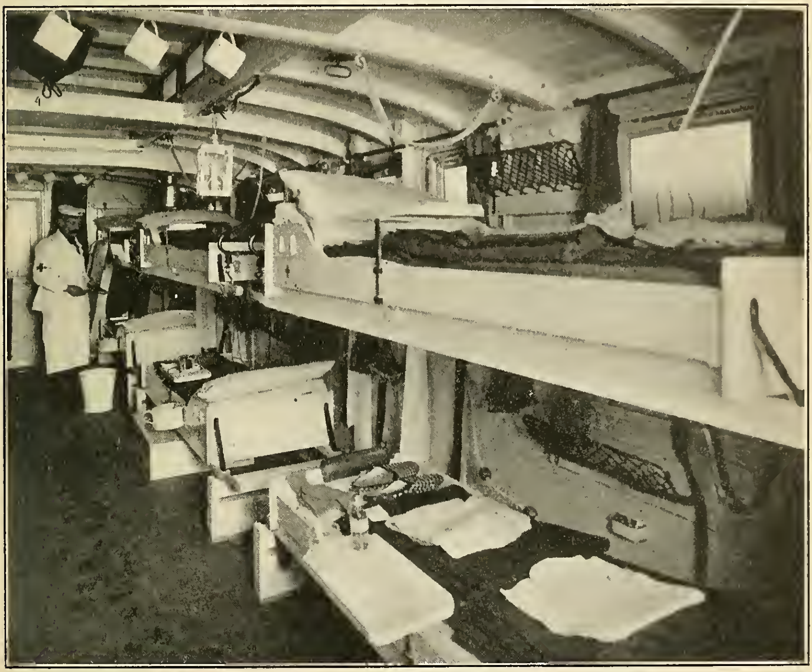


Fig. 153.—Showing the interior of a German hospital car. The cots are movable and may be used as stretchers. (Copyright by Brown & Dawson, Stanford, Conn., from Underwood & Underwood, N. Y.)

numbers of patients on the ordinary army litters. The litters are carried in tiers of three, the ends being supported by iron posts fitted snugly in the floor and roof of the car. From cross-arms on these iron posts are suspended iron rings in which the litter handles are placed. The fittings are ingeniously made so as to fold and so that they may be enlarged to fit freight cars varying in height. The rings holding the litter handles are suspended by springs which give a certain amount of resiliency to the litter.

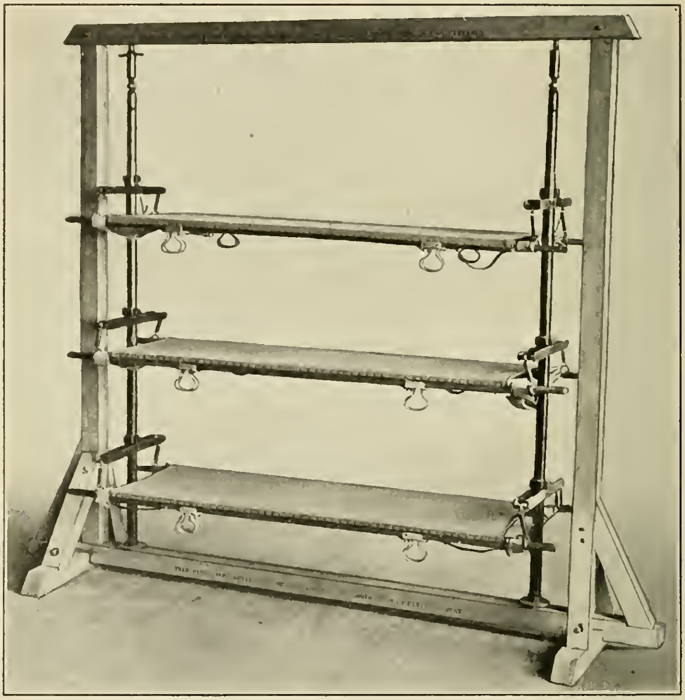


Fig. 154.—Special car fittings set up to demonstrate their use as supports for the regulation army litters. By their use an ordinary freight car may be quickly transformed into a hospital car.

Transportation by water varies greatly, depending on the type of vessel available. Usually considerable ingenuity must be exercised in transferring the patient to the vessel or from one vessel to another. In the navy a special rig and tackle is arranged to load and unload patients.

CHAPTER XIV.

NURSING AND TECHNIC.

In a book devoted to first aid it is not possible to treat exhaustively the principles of nursing. It is desired, however, to outline some of the commonly employed procedures so that the partially trained assistant may be able to carry out intelligently the orders of the attending physician, or may, in case of need, perform the simpler duties which add greatly to the comfort of the patient.

NURSING METHODS.

To Prepare the Room.—The sick room should be large and cheerful. There should be plenty of windows, preferably of southern exposure, to admit fresh air and sunlight. It should, if possible, contain a fireplace both for ventilation and for warmth, and should not be too far removed from the bath and toilet. The room should be quiet and clean, removed from noise and odors from the kitchen. It should be furnished with a bed for the patient and a cot or couch for the attendant, or two beds.

The best bed for patients seriously sick is a narrow iron bed about three feet wide and about thirty inches from the ground. The ordinary half-size bed may be conveniently used, placing blocks 6 or 8 inches in height under the legs to raise it the required distance from the ground. This is important because it is much more difficult to care for a patient in a low bed than in a high one.

The curtains should be of washable material, and there should be few hangings about the room.

Of course, it is often difficult to obtain all these requirements in the ordinary household. I consider fresh air and sunlight of the greatest importance, and will often sacrifice a great deal to secure a sufficiency of both.

To Make the Bed.—A firm hair mattress makes the best foundation for a sick bed. On the mattress is spread a blanket or quilt covered with a sheet which is spread out smoothly over the bed and tucked in on all sides.

If there is danger of soiling the bed, as is apt to be the case when wet dressings are applied or when a bed-pan is used, a piece of rubber sheeting is placed beneath the sheet or between it and the draw-sheet.

The draw-sheet is made by folding a sheet lengthwise so as to make it half its original width and then placing it across the center of the bed, the ends of the sheet being tucked in at the sides. This draw-sheet should be kept smooth and firm. It may be shifted a little several times a day so that the patient lies on a clean portion.

Over the patient is placed a sheet and one or more blankets. A thin counterpane may be used if desired.

To Change the Sheets.—In changing the lower sheet, roll the patient over so that he lies on the left side of the bed. Then starting on the right side roll the sheet lengthwise into a small roll next to the patient. Then take the clean sheet and fold it lengthwise in narrow folds as far as the middle and place the folds next to the patient, the right half of the sheet covering the portion of the bed previously uncovered. This side of the sheet is then carefully tucked in and smoothed over the right half of the bed. The patient is now rolled to the right side of the bed over the folded sheets, the soiled sheet being then removed and the clean sheet smoothed out and tucked in on the left side. The rubber sheeting and the draw-sheet may be changed in the same way.

To change the upper sheet all the other covers are removed and the clean sheet placed directly over the soiled one. The soiled sheet may be withdrawn while the clean one is held in place, the change being made without exposing the patient.

Care of the Skin.—It is extremely important that the patient's skin should be carefully cared for. A daily bath should be given and the bed kept dry and clean. Crumbs should be carefully brushed away. The back should be sponged with alcohol and well powdered with talcum at least once daily.

Bed-sores.—In poorly nourished patients who are confined to bed for long periods the pressure of the body against the bed may cause the formation of large ulcers on the hips, shoulders, or over the lower end of the spine. Rarely these sores may occur on the elbows or heels or at other parts of the body. They are usually the direct result of carelessness and neglect.

Fig. 155.—Enormous bed-sore of the back in a patient, aged seventy-eight years. (Ashhurst.)

In order to avoid this trouble, persons confined to bed for long periods should be frequently moved in bed so that the same spots are not continually pressed upon and the bed and body kept dry and clean. When a bed-sore is threatened, as shown by a slight redness of the skin, the bed should be arranged so that absolutely no pressure comes at the threatened point. This can be accomplished by the use of pillows, air rings, air cushions and other simple appliances. The affected part should be bathed daily with 50 per cent. alcohol.

Temperature.—A patient's temperature is taken with the ordinary clinical thermometer. The average normal temperature on the Fahrenheit scale is said to be 98.6°. As a matter of fact the temperature varies at different times during the day and is apt to be as low as 97° and is as high as 99° F. in normal persons. A temperature above 99° F.

is generally considered to indicate disease, although in a few cases, such as after violent exercise and in very warm weather, a rise to 100° F. may be without significance.

The temperature is most conveniently taken in the mouth, the bulb of the thermometer being placed beneath the tongue and kept in place from one to five minutes, depending on the thermometer used.

In unconscious patients and in children it is better to take the temperature by the rectum. The thermometer bulb is smeared with vaselin or other lubricant and inserted into the anus for an inch or more and allowed to remain until the temperature has registered. The rectal temperature is usually one-half to a full degree higher than the temperature in the mouth. In some cases the temperature is taken in the armpit (axillary temperature), but this is unreliable. Of the three methods the rectal is the most accurate and the axillary the least. When the temperature is of great importance, and in children and unconscious, or delirious, patients the rectal method should be used exclusively.

The clinical thermometer contains only a slender thread of mercury, which is most difficult to read. In order to overcome this difficulty the thermometers are usually made trilateral in shape, the front edge which is curved serving as a magnifying glass which enlarges the thread of mercury. Consequently, to read the level of the mercury it is necessary to hold the thermometer directly in the line of vision with the front of the angle toward you. With a little practice the level of the mercury can be easily made out.

All thermometers are self-registering. That is, the level of the column of mercury remains at the highest point. Thus a patient may take his temperature and then place the thermometer aside to be read by the physician several hours later. Because the mercury does not return to the bulb of its own accord it must be shaken down before use. This is accomplished by holding the thermometer in the hand and swinging sharply downward, as though "cracking" a whip. In practice the mercury need not be shaken entirely down into the bulb. Usually a point between 96° and 97° is sufficient.

Some thermometers are graduated according to the centigrade scale. In this scale 1° equals 1.8° F. As the zero of the centigrade scale corresponds to 32° F., to change a centigrade reading to the Fahrenheit multiply by 9/5 and add 32. Conversely, to change F. to C. subtract 32 and multiply by 5/9. For example, to convert 98.6° F. to centigrade:

$$98.6 - 32 = 66.6 \times 5/9 = 37.$$

Pulse.—If the fingers are laid gently on any superficial artery the beat can be felt and counted. This is called the pulse. The radial artery is usually the most convenient for the purpose of taking the pulse. It is located on the thumb side of the wrist and may be easily felt and counted.

The pulse should be counted for a minute and the rate given as so many beats per minute. Ordinarily we speak of the pulse-rate as 72 or 80, meaning 72 or 80 beats per minute. In addition to the rate, the size and regularity of the pulse should be noted. An intermittent pulse is one that drops a beat occasionally, while an irregular pulse is one which noticeably varies in rate or size.

We say that the normal pulse is about 72, but it varies considerably in different people, and in the same person at different times during the day. After exercise the pulse may reach 120 per minute or even higher, but in healthy individuals it should return to normal within a short time. When the pulse is below 60 it should cause suspicion of heart disease, and when above 90 it would suggest the possibility of fever. A pulse which is irregular in either force or frequency usually indicates some form of heart disease. With a temperature of 100° we would expect a pulse count of 100 and when the temperature is 103° the pulse is apt to be between 110 and 120. However, these figures are subject to wide variations, such a simple thing as the excitement of a physical examination often sending the pulse to 120 or higher.

In children the pulse is normally much faster. The normal rate in infancy varies between 100 to 120 and may rise to 140 or higher during mild febrile attacks. As the child grows older the pulse becomes slower.

Respiration.—The rate of respiration has a definite relation to the pulse, being approximately one-fourth the pulse-rate. When the rate of respiration is increased, especially when it is increased relatively more than the pulse, it may indicate disease of the lungs, such as pneumonia. In opium-poisoning the respiration may be very slow, sometimes not over eight per minute.

In taking the respiration-rate it must be remembered that breathing is partially controlled by the will, so that if the patient realizes that you are watching him breathe he will unconsciously change the rate. It is a good plan to take the pulse, and then while still holding the wrist observe the patient's breathing without his being aware of the fact.

We may say that breathing is noisy, regular, irregular, quiet, easy, difficult, using any descriptive term.

Dyspnea means difficult breathing from any cause.

Tongue.—The condition of the tongue should be noted. It is clean and moist in health, but in disease may be dry or coated. A coated tongue usually indicates some disturbance of the gastro-intestinal tract.

In fever the tongue is apt to be dry, and may become cracked and sore if neglected. During sickness the mouth and tongue should be scrupulously cared for, the teeth should be brushed, and an alkaline mouth wash[1] should be used after each meal. If the tongue is dry or cracked it should be wiped off with a mixture containing equal parts of glycerin, lemon juice, and water.

BATHS AND BATHING.

Baths are given for purposes of cleanliness or for purposes of treatment. In general, baths may be given:

1. To cleanse the body.
2. To reduce fever.
3. To quiet the nervous system.
4. To induce sweating.

Baths may be classified according to temperature as hot

[1] Bicarbonate of soda solution, 1 teaspoonful to a glass of water, may be used, or almost any of the widely advertised mouth washes may be substituted for the soda solution. The aromatic flavor of the commercial washes is sometimes desirable.

baths (100° to 105° F.), tepid baths (90° to 100° F.), and cold baths (70° to 85° F.).

Naturally, when a patient is not too sick the tub bath should be given for cleansing purposes. It must be remembered, however, that the bath may be very weakening, so that when a sick person attempts to take a tub bath a close watch should be kept by the attendant in order to be sure that fainting does not take place while the patient is in the tub.

Sponge Baths.—Patients confined to bed should receive a daily sponge bath. In order to give the sponge bath, a rubber sheet covered with a blanket should be placed over the bed in the same manner as has been outlined for changing the lower sheet. The patient is covered with a sheet and the body sponged with a sponge or wash cloth wet in warm, soapy water. One part of the body is washed at a time, rinsed off with clean water and dried before starting on another part. The daily bath is usually given in the morning and the bedding changed after the bath.

The sponge bath is sometimes given to reduce temperature. When it is given for this purpose the entire body is exposed and the water applied at a temperature of about 80° F. If the patient seems chilly during the bath a little broth or hot milk may be given.

Alcohol Sponge.—This is very easy to give. It tends to reduce temperature and acts as a sedative to the nervous system. A wash cloth or sponge is wrung out of a mixture of equal parts of alcohol and warm water and used to sponge off the body. To be the right temperature the cloth should feel a little more than tepid to the hand (about 100° F.).

In giving the sponge all the covers are removed from the patient but the sheet, and the alcohol is applied to the body beneath the sheet, without exposing the patient. After the front of the body has been well gone over with the sponge the patient is turned over and the remainder of the body sponged in the same way. The body is not dried, the alcohol being allowed to evaporate.

In fever patients, a fall in temperature of a degree, or a degree and a half, after an alcohol sponge is not uncommon.

It also often happens that after the sponge the patient, previously nervous and restless, will drop quietly off to sleep.

Tub Baths.—A hot bath may be given for the purpose of inducing perspiration, or for relaxation in certain nervous conditions. The temperature of the bath is usually about 105° F., and the duration from ten to fifteen minutes.

In order to give a tub bath properly in typhoid fever a movable tub is required which can be moved next to the patient's bed. Typhoid baths are usually given at about 80° to 90° F. The patient is carefully lifted into the tub by four attendants and allowed to lie quietly, the head resting on a support at one end of the tub, and a wet cloth applied to the forehead. During the bath the entire body should be rubbed continuously, in order to increase the superficial circulation.

While in the bath the patient feels cold, the teeth chatter, and the skin turns bluish. If the pulse grows rapid and weak the bath should be stopped.

After removing the patient from the tub he should be placed in bed on a blanket and rubbed briskly with a rough towel. A drink of hot broth is then given and a hot-water bottle placed at the feet.

Ice Baths.—In cases of sunstroke, baths may be given as described above, except that the water may be much colder, about 50° to 60° F. In order to keep the temperature low, cold water must be constantly added or a few pieces of ice may be put into the tub. During the bath the rectal temperature should be taken at intervals and the patient removed from the tub while the temperature is still several degrees above normal. The after-treatment is the same as for cold baths.

Hot Packs.—These produce sweating nearly as well as hot baths, and are less disturbing to the patient.

The bed is protected with a rubber sheet, over which a blanket is placed, and the patient's clothes entirely removed. A blanket is now wrung out of hot water (about 120° F.) and the patient wrapped in this wet blanket. The blanket when it reaches the patient is usually not more than 110° F. Plenty of drinking water should be given, so that the perspiration will be profuse. The patient is allowed to remain in pack from fifteen to twenty minutes. An ice-cap or cold compress is kept on the head and the pulse taken at intervals during the pack. If the pulse becomes rapid and weak the treatment should be stopped.

After the pack the body is rubbed dry with a towel and the patient left between dry blankets for about an hour. At the end of this period an alcohol rub is given, the body dried, and the patient made comfortable with clean, dry linen.

Fig. 156.—A hot pack being given in a case of uremia. Note the arrangement of the blankets. (Hare.)

Sweat Baths.—There are several methods of inducing sweating by the use of modified hot packs. The simplest consists of placing the patient between blankets surrounded by hot-water bottles (ordinary glass bottles filled with hot water serve very well in an emergency) and then covering him with several blankets. This usually quickly induces sweating.

Another method, sometimes called a "rum sweat," consists in surrounding the patient with hot bricks well wrapped in cloths. On these bricks raw whisky or rum is poured and the patient covered with several layers of blankets. The steam from the hot bricks surrounds the patient and soon causes sweating. Care must be taken that the hot steam does not cause burns.

Of course the patient must be given plenty of water during the sweat and the head must be kept cool, just as during the hot pack. The after-treatment is the same as that after the hot pack. Never allow the body and bed-linen, wet with perspiration, to remain unchanged for more than an hour or two after the sweat.

Foot-baths.—It is sometimes desirable to secure dilatation of the vessels in one part of the body so that the blood may be drawn from another part. Thus, a hot foot-bath is supposed to have a favorable action in colds in the head and some cases of headache. The patient, well wrapped up, places the feet in hot water, which comes to a level well above the ankles. The water is kept as hot as can be borne by pouring hot water into the tub from time to time and the bath continued for about fifteen minutes.

Sitz Baths.—This is somewhat similar to the foot-bath, except that the patient is seated in the water, the level of which extends up over the hips.

Medicated Baths.—In some cases, for purposes of counter-irritation or stimulation, other substances may be added to the water. Thus sea salt, or common salt, is valuable in certain diseases, the quantity to be added to the water varying from one to three pounds.

Ordinary Epsom salts have recently been advised for the purpose of reducing weight. About a pound is added to a tub half-full of water and a twenty-minute bath taken. The value of this treatment is largely due to the hot bath and only slightly to the content of salts.

Two or three tablespoonfuls of mustard are often added to hot foot-baths or even to the general bath. It is commonly believed that the counter-irritation adds to the effect of the hot bath.

EXTERNAL APPLICATIONS.

The Application of Heat.—Heat may be applied dry or wet. The most common form of dry heat is the hot-water bag. Although in common use the correct method of using the hot-water bag is not generally understood.

The bag should be only two-thirds full and should never contain boiling water. Patients are frequently burned with bags containing water which is too hot, so that it is always advisable to test the bag by placing it against the forearm for a short period. If it cannot be borne against the skin it should not be placed in the patient's bed, especially if the patient is asleep or only partially conscious.

If there are not sufficient hot-water bags at hand, tin cans, glass bottles, or any other suitable receptacles may be used. Hot salt-bags, hot bricks, electric heaters, or dry air may also be used. Recently the ordinary incandescent lamp has been widely used for the local application of heat.

Hot-water bags may burst or leak in the bed. They should be carefully tested before use. Hot bricks are heavy and awkward, but they retain their heat for a long time.

Moist heat is supposed to be more penetrating and relaxing than dry heat. It may be used in the form of hot compresses, poultices, or stupes.

Hot Compresses.—Several layers of gauze are wrung out of hot water and applied to the body before they have an opportunity to cool. They may be covered with cotton or oiled silk and left in place for ten minutes or longer, or they may be changed after a few minutes when they begin to grow cold.

Stupes.—A stupe consists of about two layers of flannel wrung out of hot water and covered with a towel or piece of oiled silk. To wring out a stupe it should be placed in a towel and the water wrung out by twisting the dry end of the towel; or a hem may be sewn in each end of the towel large enough to admit the passage of a thin stick of wood at each end. These two sticks serve as handles with which to wring out the stupes which are lifted from the water with a stick. After it is wrung out, a stupe is tested with the hands and placed in position as soon as the patient can stand it. It should be changed every five minutes.

Turpentine Stupes.—These are given exactly as the ordinary stupes, except that the counter-irritation is increased by the use of turpentine. The most satisfactory way to apply the turpentine is to wet the surface of the skin with spirits of turpentine before applying the stupes. These stupes should never be applied continuously, or the skin at the point of treatment will become irritated and inflamed. When continuous action is required the stupes may be used for thirty minutes every three or four hours.

Flaxseed Poultice.—This is made by mixing flaxseed meal slowly into boiling water until a thick paste is formed. It is then cooked for about five minutes and removed from the fire and well beaten to make it light. The mass is then spread upon a piece of cotton cloth, forming a layer about one-fourth of an inch in thickness. The excess of cloth should extend about one inch on all sides. This edge is turned over, preventing the spread of the flaxseed, and the surface of the poultice is covered with a piece of very thin gauze. The gauze is placed against the patient's skin, care being taken not to burn him. A poultice may be left in place for about an hour and should never be used a second time. If continuous poulticing is desired the second poultice should be ready before the first is removed.

If flaxseed is not obtainable, oatmeal or cornmeal may be used.

Mustard Plaster.—One part of mustard is mixed with four or five parts of flour,[1] sufficient lukewarm water being added to make a paste. This mixture is smeared in a thin layer upon a thin piece of gauze and the plaster held in place by a bandage. Never make a mustard plaster with hot water, for by this means part of the strength of the mustard is destroyed.

The plaster should be left in place until the skin is reddened—about twenty minutes—and then removed. Never go away and forget the plaster, for if it is left on too long blistering will surely result. After the plaster has been removed a little vaselin may be applied to the reddened skin.

Cold Compresses.—These are very similar to hot compresses, except that they are wrung out from cold water. Considerable reaction may be secured from the cold compress applied to the body and then covered with a towel or piece of oiled silk. At first the skin is pale, but after a short period

[1] For children the plaster should be weaker, 1 part of mustard to 8 or 9 parts of flour.

reaction sets in and the skin becomes flushed and warm. These compresses should be changed about once an hour.

When compresses are applied solely for the effect of cold they should be changed every few minutes because the compress becomes quite warm after ten to fifteen minutes.

The Ice-bag.—This is a rubber bag with a large screw top. Small pieces of ice are placed in the bag with a little water and the top screwed on, care being taken to expel all the air before fastening on the top.

Never apply an ice-cap directly to the skin. If it is not separated from the skin by the use of thin gauze, or other material, a frost-bite of the skin may result, a so-called "ice-cap burn." The ice-cap, if the skin be protected in the manner just described, may be left on continuously. The ice must be renewed about every two hours.

COUNTER-IRRITANTS.

These are usually chemicals which, when placed in contact with the skin, cause redness and irritation. They relieve pain and deep inflammation by their action upon the blood-vessels, increasing the circulation not only in the skin but also in the deeper parts. Counter-irritants may cause simply a reddening of the skin (rubefacients) or they may produce blisters (vesicants).

While the ordinary counter-irritants are chemical substances, such as iodin or oil of mustard, yet, under certain circumstances, physical forms of counter-irritation may be used.

The simplest form of physical counter-irritation is that due to the rubbing of the skin. We all recognize that many of the small pains may be "rubbed away." In general it is better to rub toward the heart. That is, in such a manner as to empty the superficial veins by rubbing them in the direction of the venous flow. Massage is simply scientific rubbing.

In rubbing a painful area of the body the skin is soon apt to become sore as a result of friction unless some form of lubricant is used, such as vaselin or talcum powder.

Electricity.—Electricity is another form of counter-irritation. It may be used either in the form of an electric current or through the medium of the *x*-rays or thermic spark. The action of the *x*-rays and electricity is only partially comprehended and their use is not without danger. They should, consequently, be employed only under skilled direction.

The Cautery.—This is sometimes called the actual cautery and is simply a metal instrument heated to a cherry-red color used to relieve pain, to cause absorption of effusion, and to control bleeding.

In hospitals the Paquelin cautery is used. This is an instrument with a platinum tip, first heated in the flame of an alcohol lamp and maintained incandescent by a small stream of gasoline or benzine vapor which is pumped into the tip by a small rubber bulb. This is similar to the cautery which has come into popular usage in the art of pyrography.

In using the actual cautery the red-hot instrument is made to touch the skin lightly at many separate points over the painful area. The instrument is kept in motion and touches the skin only for a fraction of a second. If this is properly performed the skin will barely be seared and there will be no blister formation.

Cupping.—Dry cups not only cause counter-irritation but actually cause an extravasation of blood beneath the skin. They act through suction caused by the application of a cup containing heated air against the skin, the cooling of the air in the cup causing a vacuum which tends to draw the skin upward into the cup.

To cup a patient about a dozen cups are required. These are small thick glasses about one-third the size of the ordinary tumbler. A swab is made by wrapping a little cotton tightly about the end of a probe. This is dipped in alcohol and lighted, forming a small torch.

One of the cups is now taken in the left hand and the burning torch held inside of it for an instant to exhaust the air, after which the cup is placed quickly against the skin and held in place. The skin can be seen to be drawn up into the cup. This procedure is repeated until the required number of cups are applied. In applying the cups be careful not to get the edges too hot, and not to allow the alcohol to trickle down inside of the cup. A little practice on yourself will soon tell you how long the torch should be left inside the cup, and will demonstrate to you how necessary it is to avoid heating the edges of the cup.

To remove the cup, press the skin away on one side, thus allowing the air to enter the cup, which then falls off. Each cup is left in place from three to ten minutes. It is then removed and replaced after exhausting the air again. After use the inside is covered with moisture so that each cup must be dried before it can be reapplied. Cupping may be

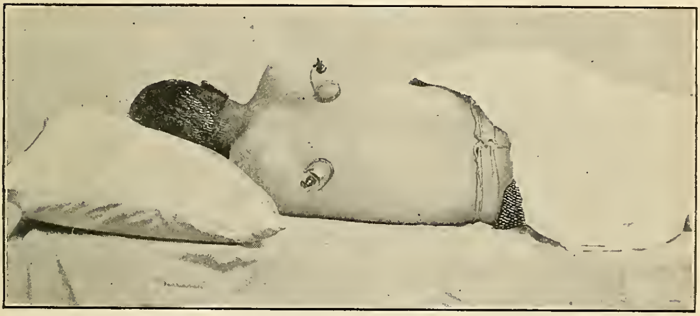


FIG. 157.—Cups applied to the back. (Hare.)

done several times daily, usually being carried on over a period of fifteen to thirty minutes at each application. There is no danger in placing a cup several times over the same spot.

In some cases the suction may be so great that a black-and-blue spot results. This has no harmful consequences and will disappear after a few days.

Wet cups are sometimes given by a physician. They are exactly the same as dry ones, except that small incisions are first made in the skin with a sharp knife.

Tincture of Iodin.—This is a chemical irritant and is applied to the skin with a brush. If the skin is tender it may blister. Ordinarily it is painted on the skin and is allowed to dry, requiring no further care. It should be applied heavily enough to give a moderately deep brown color. After a few minutes there is a slight burning sensation.

If there is a severe burning sensation it has been used in too strong solution or too much has been applied. The excess should be removed with alcohol.

The action of tincture of iodin as a counter-irritant must not be confused with its use in wounds. In wounds it is used solely for its antiseptic properties and in no way for counter-irritation. It is merely a coincidence that it happens to be useful for both purposes.

Liniments.—Many different liniments are used for counter-irritation. The rubbing that accompanies the application of the liniment often does more good than the liniment. All the various liniments contain some substances which in themselves act as irritants. Chloroform, capsicum, menthol, and camphor in watery or alcoholic solutions are the substances most commonly used. Chloroform liniment is generally harmless and widely used. It should be allowed to evaporate before a bandage is applied, as otherwise it may cause blistering.

Cantharides, or Spanish fly, is extremely irritating to the skin. It is sometimes used in the form of cantharides plaster and left on for six to eight hours, to cause blister formation. If the blister does not occur by that time the cantharides plaster should be removed and a flaxseed poultice applied. This usually raises the blister promptly. Blisters are seldom used, because they may become infected and result in troublesome sores.

Ointments.—Many of the drugs (menthol, camphor, oil of wintergreen, etc.) commonly used in the form of liniments may be combined with vaselin or other similar vehicle to form ointments. These may be rubbed into the skin or smeared on and covered with cotton.

Because ointments may sometimes be used as counter-irritants it does not follow that all ointments are irritating to the skin. The name ointment simply indicates a semi-solid oily substance which may be applied to the skin. Ordinarily, ointments are bland and healing. Special ointments, such as wintergreen ointment or capsicum ointment, may act as counter-irritants by virtue of the drugs they contain.

A word of warning should be given in reference to all forms of counter-irritants. There is a limit to the ability of the skin to withstand counterirritation for more than a few days. When the skin remains reddened and shows a number of small reddish elevations (that is, an eruption) between the periods of application of the particular counter-irritant, the treatment should be omitted for two or three days in order to allow the skin to regain its normal appearance.

STERILIZATION.

Anyone who is called on for first aid or who assists a physician in the care of patients may be required to prepare instruments and supplies. The various forms of sterilization will be given, the attempt being made to indicate in detail those procedures which may be carried out in an ordinary household.

Instruments.—These are easily sterilized. A basin is secured large enough so that all the instruments may be covered with water and the instruments allowed to boil from five to ten minutes. In order to prevent rust a little sodium carbonate (washing soda) may be added to the water.

Sharp instruments, such as knives and scissors, become quickly dulled if often boiled. Consequently, some surgeons prefer to sterilize sharp instruments in a tray containing 70 per cent. alcohol. This is not as satisfactory a form of sterilization as boiling.

In emergencies all the instruments may be sterilized in alcohol or other form of chemical disinfectant. For a single instrument such as a knife or probe, the plan of dipping one end of the instrument into pure phenol and then washing off the excess with alcohol gives very good results.

A 5 per cent. solution of carbolic acid may be used when it is impossible to secure heat, the instruments being preferably left in the solution for a half-hour or longer.

Solutions.—Water and salt solution are the two liquids most commonly requiring sterilization. They may be sterilized by boiling. In preparing solutions for the physician it is well to have two large vessels of boiled water, one hot and another which has been allowed to cool. When needed these may be mixed together so that a solution of the proper temperature may be obtained.

Antiseptic solutions should preferably be made with boiled water, but when it is not obtainable they may be prepared from ordinary tap water which, as a rule, contains very few bacteria.

Glassware and Graniteware.—Boiling is a suitable method for the sterilization of basins, jars, bottles, glass, graduates, and other similar supplies, but, owing to their bulk, it is frequently impracticable to boil them all. In such cases a large tank of bichloride of mercury solution (1 to 1000) is prepared and the supplies left in this solution for several hours. If the ware is clean this solution will kill practically all the organisms. If desired, weak carbolic acid may be used in the same way.

Never place the bichloride solution in direct contact with any form of metal, as the mercury combines with the metal, causing rapid corrosion.

Towels and Dressings.—In hospitals and surgical supply houses towels and dressings are sterilized in a special apparatus called an autoclave, by the use of steam under pressure.

In emergency practice they are the most difficult form of supplies to sterilize satisfactorily. Consequently, it is advisable to carry a sufficient supply sterilized, wrapped in cotton, or muslin, covering or in sealed packets, ready for use. The interior of such packets remains sterile for a long time.

For an emergency dressing a piece of gauze may be boiled, or wet with 50 per cent. alcohol, but this is far inferior to dry gauze.

A sterilizing apparatus similar to the Arnold sterilizer may be improvised by making a wire basket which will hang inside an ordinary wash-boiler and placing small packages of dressings or towels, carefully wrapped in a protective covering of muslin, in this improvised basket. Water is then poured into the boiler, which is then covered and placed on the stove. After the water has boiled for at least an hour the dressings are removed and placed in the oven to dry. When fully dry the dressings are ready for use. Care must be taken not to burn the dressings in the hot oven.

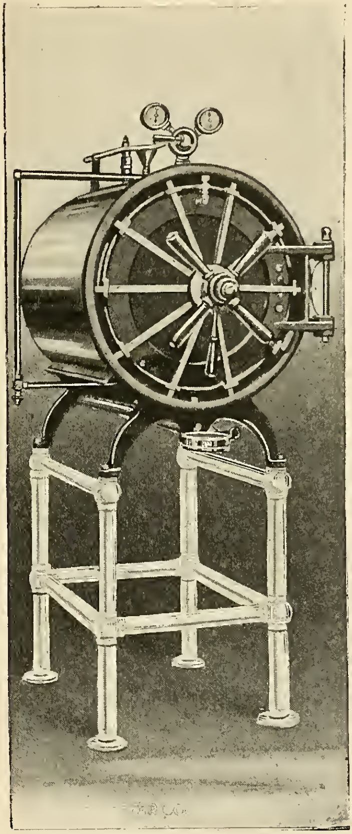


Fig. 158.—Autoclave sterilizer used in hospitals. (Brewer.)

Hands and Skin.—The sterilization of the hands has already been discussed in the chapter devoted to Wounds. Remember that a thorough scrubbing with soap and water is much better than perfunctory dipping in antiseptic solutions.

In order to prepare the patient's skin for minor surgical operations it should be well washed with soap and water and then rinsed off with boiled water followed by alcohol, or it may be rapidly prepared by simply painting it with tincture of iodin. Remember that after the hand or skin, or anything else for that matter, has been sterilized, it no longer remains sterile after it has been in contact with some non-sterile object. Consequently sterile supplies and utensils should never be handled except after sterilization of the hands.

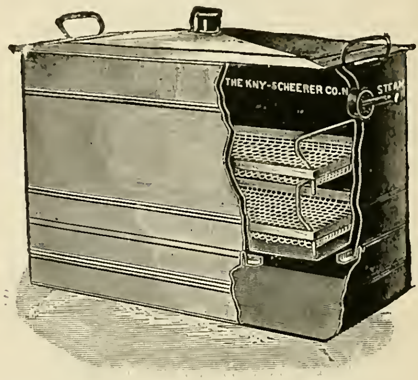


FIG. 159.—Arnold sterilizer for use in private houses and in physician's office. (Brewer.)

Rubber Gloves.—These may be sterilized either by boiling or by immersing in bichloride of mercury solution for an hour or longer. When a great many cases are being dressed, as in the receiving ward of a hospital, rubber gloves may be worn and washed in water and then dipped in bichloride solution between dressings.

DIET.

The diet of the sick depends largely upon the orders of the physician in attendance. When patients are feverish and sick and there has been no special diet ordered by the physician it is wisest to give only fluid food.

The forms of fluids which may almost invariably be given without danger are: clear broth, beef tea, orange-albumen water,[1] tea and coffee. In addition, milk, buttermilk, cocoa, and gruels are nourishing and seldom harmful. Fluids are given every two or three hours, about 6 ounces (a cupful) at each feeding.

During convalescence a light diet, consisting of custards, soft-boiled eggs, well-cooked cereals, ice-cream, and milk toast may be given.

Especially in conditions associated with disturbance of the stomach or bowels, fried foods, meats, vegetables, pastries, and raw fruits (except fruit juices) should be avoided.

DRUGS.

While the administration of drugs is not properly a part of first aid, it is desirable that the student should familiarize himself in the use of a few drugs and solutions commonly used.

The dosage of drugs as usually given is the adult dose. If given to children the dose should be correspondingly smaller. Generally speaking, the adult dose is given after the age of eighteen years and the dose for children may be roughly calculated according to age: thus if a child is three years old the dose is $\frac{3}{18}$, or $\frac{1}{6}$, of the adult dose. Drugs containing opium are especially dangerous in infancy and old age, and should never be given without specific orders from the physician in attendance.

Stimulants.—Coffee is one of the best stimulants which we possess. It should be given without sugar or cream and as hot as can be borne. Whisky and brandy are commonly considered as stimulants. In very small doses they may have a slightly stimulating effect.

Aromatic spirits of ammonia, in 10-drop doses, well diluted with water, may be given every fifteen to twenty

[1] This is made by mixing the juice of an orange with the white of an egg and adding a little sugar and sufficient ice-water to fill a glass. The mixture is well shaken and served cold.

minutes for four or five doses. It has a temporary, mild, stimulating effect.

Tincture of nux vomica contains strychnin. It may be given in 10-drop doses three or four times daily. Strychnin itself is a very powerful drug and should be given in very small doses, not over $\frac{1}{30}$ grain.

Sedatives.—Sodium bromide is a safe form of sedative. Ten to 20 grains may be given and repeated after a few hours. It should not be used over long periods except under the advice of a physician.

Aspirin, 5 to 10 grains, will sometimes quiet nervous irritability and deaden pain. It should not be taken repeatedly or more than twice in one day.

Cathartics.—For active purging in acute illness castor oil is to be preferred. The dose is from 1 to 2 tablespoonfuls. If sufficient is given the bowels will move in from two to four hours.

Saline cathartics include Epsom salts, Rochelle salts, sodium phosphate, and many others. The dose is about one tablespoonful. Seidlitz powders, citrate of magnesia, Pluto water, Apenta water, and others of the same type all contain salts which have a cathartic action. They cause movement of the bowels in from one to three hours. The dose varies according to the strength of the solution.

The principal vegetable cathartics are aloes, cascara, and senna. They usually act after six to eight hours. The dose varies with the drug and the strength of the solution used.

White mineral oil is a mild cathartic which is widely used. It does not cause active catharsis but only a slight looseness of the movement. It is given in doses of 1 or 2 tablespoonfuls daily, and may be safely taken for long periods.

Milk of magnesia is a mild cathartic, which is especially useful for children. One or 2 teaspoonfuls is the ordinary dose for a child.

Calomel causes active purging. It is best given in $\frac{1}{10}$-grain doses, every ten to fifteen minutes, until a grain is taken. A saline cathartic is usually given six to twelve hours later to remove the excess of calomel from the intestines.

Anodynes.—These are drugs which deaden pain. Phenacetin (5 grains) is one of the most useful. In very severe pain of an acute character, codein or paregoric may be given, but only on the prescription of a physician. None of these drugs should be used repeatedly.

Disinfectants and Antiseptics.—Disinfectants and antiseptics have already been discussed. One of the safest of mild antiseptics which may be used for wet dressings, for wet compresses, and as a mild antiseptic for use in wounds is a solution of boric acid.

Boric Acid.—Boric acid, or boracic acid, is a mild acid which comes in powdered form. A 1 per cent. solution may be made by mixing a rounded teaspoonful of the powdered drug in a pint of boiling water. It may also be used in saturated solutions which contain about 5 per cent. of the drug. This is poisonous if taken internally in large quantities, but has no poisonous effect in small doses.

Bicarbonate of Soda.—This is frequently used as a mouth wash. It is not antiseptic, but because it dissolves mucus it makes an excellent gargle when mixed with hot water. A 1 per cent. solution is made by dissolving 1 teaspoonful of the dry powder in 1 pint of water. A saturated solution is, approximately, 8 per cent. It may be used in the form of a wet dressing (especially for burns), or may be given internally in doses up to one teaspoonful of the powdered soda.

Bichloride of Mercury.—This is very poisonous. It is used in solutions of 1 to 1000 as an antiseptic, but should never be used in the eyes or mouth. One $7\frac{1}{2}$-grain tablet added to a pint of water makes a 1 to 1000 solution. If used for a wet dressing it should be further diluted to 1 to 5000.

Bichloride solutions should never be applied to an area previously painted with iodin, as the mercury combines with the iodin, forming a very irritating mercuric iodide which soon blisters the skin.

As little as $\frac{1}{10}$ grain of bichloride of mercury taken internally may result in symptoms of poisoning.

Carbolic Acid (*Phenol*).—This is a valuable antiseptic, but is apt to cause gangrene if used for wet dressings. It is crystalline when pure, and liquid after a little water has been added. This is called strong carbolic acid (95 per cent.). It is not further soluble until sufficient water has been added to make a 5 per cent. solution (dilute carbolic acid). Any strength below 5 per cent. can be obtained by adding suitable amounts of water. It is used principally for the sterilization of instruments and supplies.

FIG. 160.—Gangrene of the finger, the result of a wet carbolic dressing for only twenty-four hours. (Ashhurst.)

Tincture of Iodin.—This is an alcoholic solution of iodin, and is in common use. If more than a few drops is swallowed it is poisonous. Ordinarily it is used externally for counter-irritation and sterilization of the skin. Because of the danger of causing blisters it is safer to dilute the tincture by adding an equal quantity of alcohol when it is used on the skin. When tincture of iodin stands for a long time the alcohol evaporates, leaving the iodin in strong solution. Consequently, when an old tincture is used alcohol should be added until the stain on the skin is only moderately brown. The very deep brown stains are apt to raise blisters.

Emetics.—These drugs have already been given in the treatment of poisoning.

Many other drugs, such as syrup of ginger, bismuth, alum, spirits of camphor, etc., may find occasional use in first-aid work.

In using drugs care should be taken to use only those which are comparatively harmless in the doses given, and the uses of which are clearly understood. In the use of drugs, as well as any other form of treatment, no remedy should be given unless its use is well understood and the indications for its use are definite and clear. Remember that the wrong treatment is usually worse than no treatment.

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